PLANNING AND ESTIMATING MANUAL

FOR

DOMESTIC AND STOCK WATER SUPPLY

Prepared in The
Office of The District Engineer

U.S. FARM SECURITY ADMINISTRATION,
DISTRICT 5 - DALLAS, TEXAS

FOR

REGION VIII and REGION XII

September 8, 1942

ADDENDUM NO. 1
PLANNING AND ESTIMATING MANUAL
FOR
DOMESTIC AND STOCK WATER SUPPLY
February 6, 1943

PURPOSE:

This addendum is issued to amplify the first sentence under section entitled "STORAGE TANK TOWER" as contained on Page 7 of the referenced manual and to add general specifications for native stone construction where such material is abundant and can readily be obtained.

REQUEST:

Delete by striking out the above referenced sentence as follows:

"Only wood towers are recommended"

Insert this addendum to evidence the following amplification as well as to incorporate in the manual the specifications for "Native Stone Masonry" as contained herein.

Wood towers are recommended where the tower is to serve only for a support for the storage tank. Where a multiple purpose unit is desired the tower may be constructed of native stone masonry in accordance with the following specifications:

NATIVE STONE MASONRY

In instances where a multiple purpose storage tank tower is desired, such as an enclosed tower that will further serve as a milk or bath house, the unit may be constructed of native stone masonry. It is usually found that the desire for this type of construction is pronounced in vicinities where native stone is abundant and can be secured at no material cost to the farmer, thereby bringing the cost of the installation within an economic limit of construction. The storage tank may also be constructed of native stone masonry provided that proper sanitary measures such as a cover, etc., are provided.

Workmen skilled in the craft of masonry construction should be employed for all installations of masonry type in order that a workmanlike and attractive unit will result.

The stone should be native stone and should be clean, hard, and of a type known to be durable. The stone should be laid with a cement mortar made of 1 volume of Portland Cement to 3 volumes of damp, loose mortar sand to which may be added not more than

10 lbs. of hydrated lime or lime putty per sack of cement. Sufficient water should be added to the mix to produce, after thorough mixing, a mortar of good working consistency.

In constructing the tower the stone should be laid on a concrete foundation similar to the foundation shown in the manual for "Enclosed Water Tower", Fig. 6. The foundation should be checked to see that it is level and straight and chalk lines stretched along the outside of the walls to serve as guide lines in building the corners. Corners should be built 2 or 3 courses high, then chalk line stretched between corners along the outside faces to serve as guides in laying the walls. A good bed of mortar should be placed on the foundation and the stone carefully pressed into the mortar with the outer edge touching the chalk or guide line. Vertical joints should average about 1/4 to 3/8" in thickness with horizontal or bed joints not more than 1/2 inch thick. Walls and corners should be continuously checked for vertical or plumb with plumb line or spirit level.

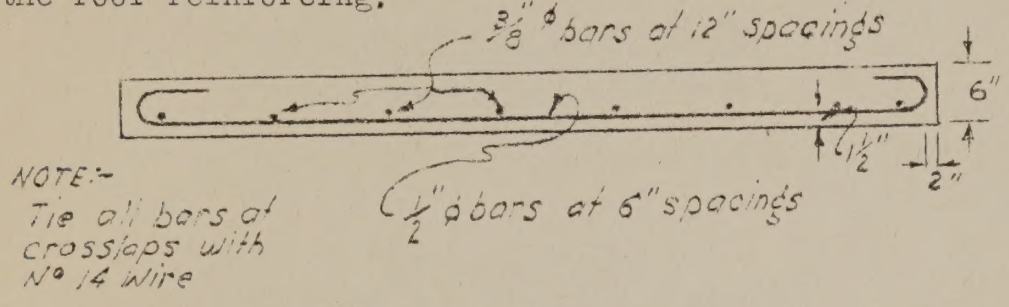
Window and door frames are readily built into the wall. They should be temporarily braced into place before the walls on either side are built care being taken that top of window or door frame is placed at the exact course height where lintels* are to be installed. After the walls are brought up on the sides of the window and door frames the concrete lintels are set in place. To add to the attractiveness of the masonry both vertical and horizontal joints should be tooled.

The floor and roof should be concrete with minimum dimensions and reinforcement as follows based on an outside tower dimension of 8 feet and wood or metal storage tank of not to exceed 56 Bbls. capacity. For stone storage tank not to exceed 30 Bbls. capacity and a minimum of 6' inside diameter.

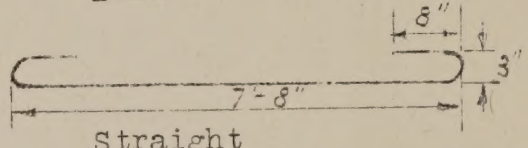
	Thickness or Slab Depth	Steel Reinforcing
Roof	6"	1/2" ϕ Bars 6" Spacings - Horizontal 3/8" ϕ Bars 12" spacings - Transverse
Floor	4"	Welded Wire Fabric or heavy gauge hog wire

*Lintels are precast concrete blocks placed above door and window openings to carry the stone course across the opening. Lintels should be the height and width of a stone course but not less than 6" in height. The length is determined by the width of the opening plus a minimum 8 inch bearing on each side of the opening. Lintels should be reinforced with two 3/8" ϕ reinforcing bars placed in the concrete 2" up from the bottom of the lintel with each bar being 2 inches in from the side of the lintel.

Roof slab reinforcement should be placed in the bottom portion of the slab $1\frac{1}{2}$ inches up from the bottom of the slab. Floor reinforcement may be placed in the center of the slab. The following section of roof slab indicates the method of placing the roof reinforcing.



SCHEDULE OF REINFORCING BARS

Mark	No.	Size	Length	Bend
Longitudinal	16	½" ϕ	9' 2"	
Transverse	8	3/8" ϕ	7' 8"	Straight

Prior to pouring the concrete for roof and floor slabs all piping, drains, etc., should be in place through the slabs or sleeves or openings provided so that same may be installed after the slabs are poured without chipping or drilling the concrete.

Where tanks are constructed of stone or purchased as a manufactured unit without cover an adequate cover should be provided. A suitable cover for round tanks is illustrated as Figure 8 in the "Planning and Estimating Manual for Domestic and Stock Water Supply".

Original Manual Prepared by
Soil Conservation Service
Region VI

Revised in The
Office of The District Engineer
Farm Security Administration
District 5 - Dallas, Texas

NOTICE

All references to and illustrations of any particular make of equipment which are used herein are used for the specific and sole purpose of conveying information. Under no conditions shall the use of illustrations and references used herein be construed as recommendations of these makes over competitive makes of equal quality.

GLOSSARY OF TERMS

CYLINDER	The word cylinder as used in this manual refers to what is technically called a working barrel. A working barrel is so constructed that the valves can be removed and pulled up through the pipe without the necessity of having to pull the pipe.
ELEVATION	Elevation as considered in Table 1 designates the vertical distance between the water level from which the water must be pumped to the top of the storage tank in which the water is to be stored.
G. P. D.	This stands for gallons per day in Table No. 1.
LEAD PIPES	This term is used to designate all underground pipe which lead from the supply pipe to the point of use of the water.
RISER TUBING	This term refers to the pipe through which the water is pumped from the well to an elevation from which it will flow into the storage tank.
SUPPLY PIPE	Supply pipe as indicated in this manual designates the vertical discharge pipe from the overhead storage tank until it goes into the ground. At the point of reduction the pipes are then spoken of as lead pipes.

GUIDE FOR PLANNING AND ESTIMATING COST OF DOMESTIC AND STOCK WATER SUPPLY

GENERAL

A few important factors should be kept in mind while selecting the sites for well and elevated storage tank locations. These are:

1. A well should always be located above or out of the drainage line and not less than 100 feet from barns, chicken houses, hog pens, stock lots and outdoor toilets.

2. A well should not be located in a natural drainage way unless the only possible water is found there. When such a location is made, provision should be made to prevent damage to the well by runoff water.

3. When possible, the well and storage tank should be located on the high spot of the farmstead and near the house.

4. The elevated storage tank should be located so as to eliminate necessity of excessively high tower.

The discussions and specifications which follow are not expected to meet all conditions which may arise in the field. It is expected, however, that the information and instructions contained herein will cover problems arising while planning the average installation.

WATER REQUIREMENTS

The following requirements are based on the average daily needs over a period of one year except for the garden. Under extreme summer weather conditions the requirements may be greather than these listed, while in winter they will likely be much less. These figures are considered as a safe basis for design.

DAILY WATER CONSUMPTION

1. Person - 50 gallons (This includes requirements for bath and is recommended as the figure to use even though a bath installation may not be planned at present).

2. Beef cattle - 15 gallons/head.

3. Dairy cattle - 30 gallons/head.

4. Horses and mules - 15 gallons/head.

5. Sheep and goats - 2 gallons/head.

6. Mature hogs - 3 gallons/head.

7. Shoats - 1.5 gallons/head.

8. Chickens - 3 gallons/100.

9. Turkeys - 6 gallons/100.

10. Garden - 250 gallons/1000 sq. ft.

The estimate for a garden is based on the requirement of 1 foot of water per month for the months June, July and August. Since this constitutes an extended period, the well must be designed to supply the daily requirements unless an excessively large storage is available.

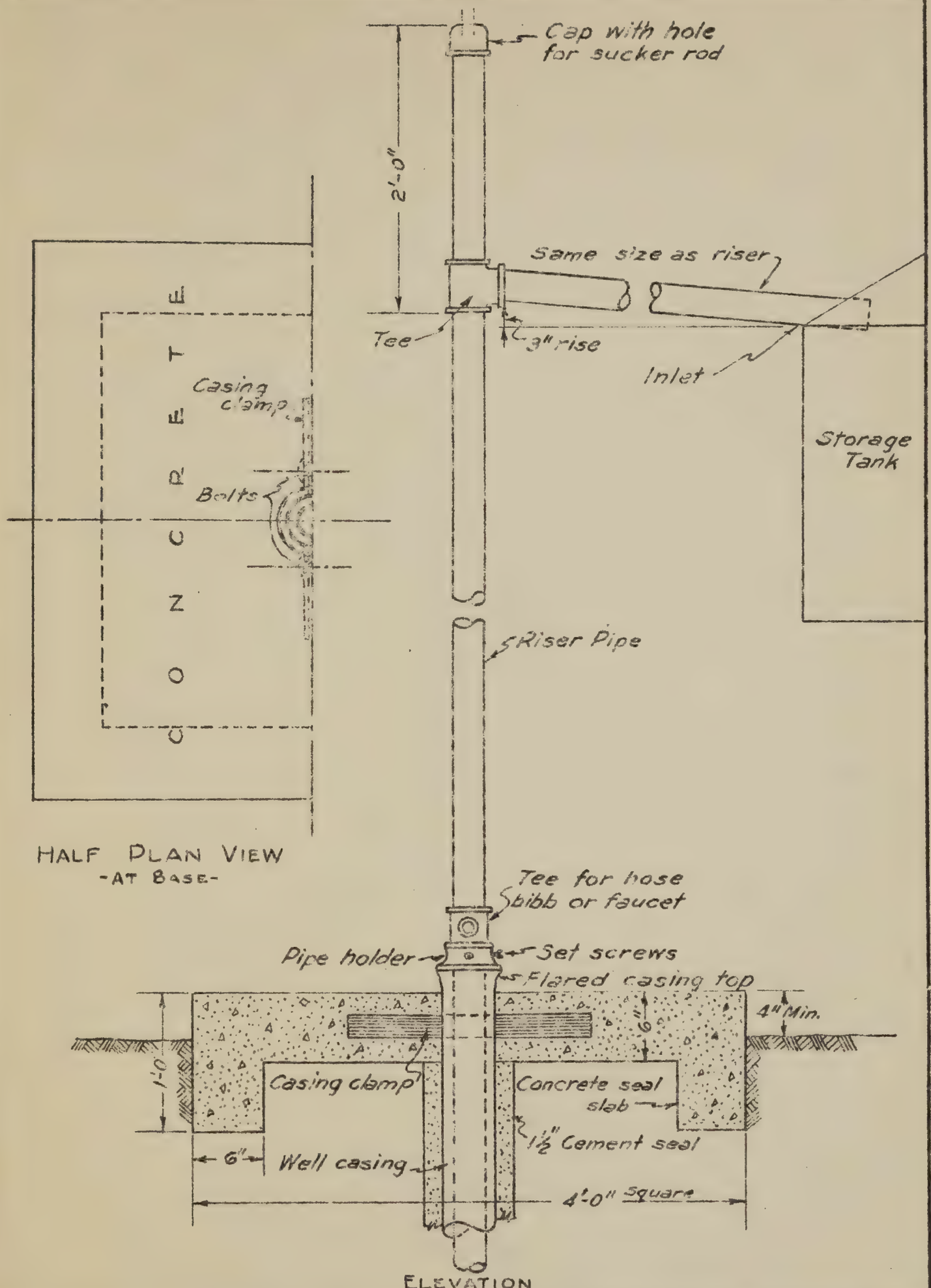
CYLINDER

The cylinder size should be determined by the water requirement, depth of well, and size of wheel. It is recommended that the pumping unit (wheel and cylinder) be designed to produce three times the daily water requirement during a 24-hour period based on a continuous wind with an average velocity of 15 miles per hour. Therefore, if the daily requirement of a farm unit is 1500 gallons, determine from Table 1 the wheel and cylinder size necessary to provide 4500 gallons with a 24-hour period for the depth of well applicable to the community assuming a continuous average 15-mile-per-hour wind.

Do not use too large a cylinder. A windmill with a small cylinder running, pumps more water than can be pumped with a larger cylinder standing still.

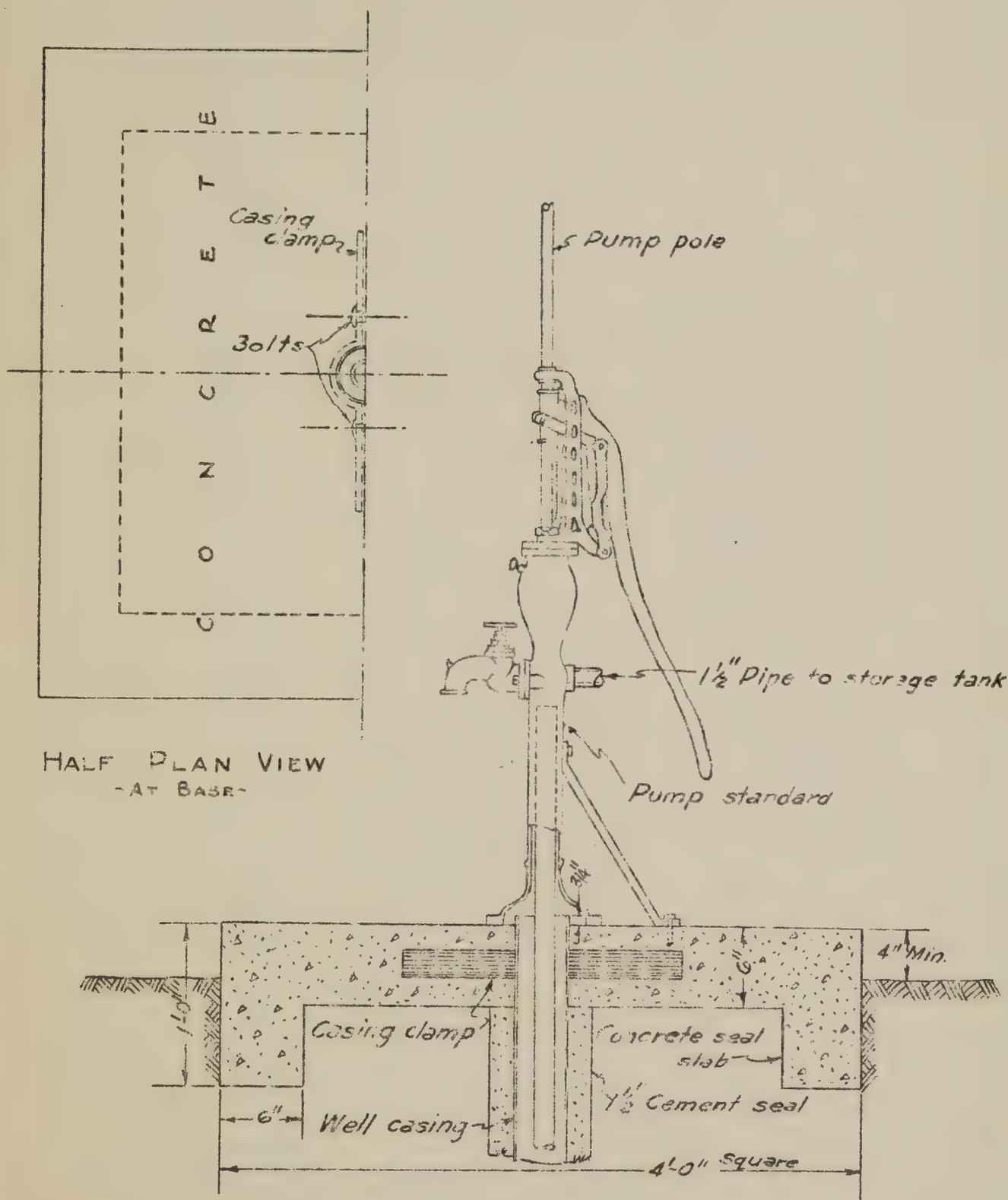
It is recommended that a cylinder be used, the leathers of which can be replaced by pulling the sucker rod only. The top cap of this type cylinder is the next standard pipe size larger than the cylinder size. This allows the valves to be withdrawn from the cylinder for repairs or leather replacement without pulling the pipe. The other type cylinder is larger than the pipe through which it pumps the water. It is necessary to pull the pipe in order to repair it or replace the leathers. Such a cylinder should never be used in any but very shallow wells (below 50 feet) and then only at the insistence of the cooperator after its disadvantages have been explained to him.

The sucker rod should be set so that the valves work in the upper portion of the barrel first and then lowered as the barrel wears larger. This keeps that part of the barrel above the valves always the same size or larger than the portion of the barrel in which they are working.



F. S. A. DALLAS, TEXAS	WELL CASING FOR WINDMILL INSTALLATION	OFFICE OF DISTRICT ENGINEER DISTRICT Nº5 AUG. 1942

FIG. 1



HALF PLAN VIEW
-AT BASE-

ELEVATION

F. S. A. DALLAS, TEXAS	WELL CASING FOR WINDMILL INSTALLATION WITH PUMP STANDARD	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 AUG. 1942

FIG. 2

PUMPING CAPACITIES OF DEMPSTER BACK-GEARED WINDMILLS FOR VARIOUS ELEVATIONS

These Capacities are Based on a 15 Mile-per-Hour Wind for Small Mills and 18 to 20 Mile-per Hour Wind for Larger Mills

Size Mill Feet	Str. In.	15-Ft. Elevation Cyl. In.	GPD	25-Ft. Elevation Cyl. In.	GPD	35-Ft. Elevation Cyl. In.	GPD	50-Ft. Elevation Cyl. In.	GPD
6	5	4	15768	3½	12000	3	8808	2½	6096
8	5½					4	17184	3½	13392
8	7½					3½	18096	3	13224
10	5½							4	15024
10	7½							3½	15720
12	10								
12	12								

		75-Ft. Elevation		100-Ft. Elevation		125-Ft. Elevation		150-Ft. Elevation	
6	5	2	3912	1-7/8	3432				
8	5½	2-3/4	8160	2-1/2	6672	2-1/4	5448	2	4320
8	7½	2-1/2	9336	2	5880				
10	5½	3-1/2	11520	3	8496	2-3/4	7128	2-1/2	5880
10	7½	3	11568	2-3/4	9744	2-1/2	8016	2-1/4	6528
12	10	4	23496	3-1/4	15504	3	13224	2-3/4	11112
12	12	3-3/4	24792	3-1/4	18624	2-3/4	13344	2-1/2	11016
14	10					3-3/4	17208	3-3/4	17208
14	12					3-3/4	20688	3-1/4	15504

		200-Ft. Elevation		250-Ft. Elevation		300-Ft. Elevation		350-Ft. Elevation	
10	5½	2-1/4	4728	2	3768				
10	7½	2	5160	1-7/8	4536				
12	10	2-1/2	9192	2-1/4	7440	1-7/8	5184		
12	12	2-1/4	8904	2	7032	1-3/4	4488		
14	10	3-1/4	12912	2-3/4	9240	2-1/4	6192	2-1/4	6192
14	12	2-3/4	10968	2-3/4	10968	2-1/4	7416	2-1/4	7416

		400-Ft. Elevation		450-Ft. Elevation		500-Ft. Elevation		600-Ft. Elevation	
14	10	2-1/4	6192	1-7/8	4320				
14	12	1-7/8	5136	1-7/8	5136				
16	12	3-1/4	12408	2-3/4	8904	2-3/4	8904		
16	16	2-3/4	11832	2-1/4	7920	2-1/4	7920		
18	12	3-3/4	14040	3-1/4	10536	3-1/4	10536		
18	16	3-1/4	14064	3-1/4	14064	2-3/4	10056		

Elevation in the above table means the vertical distance between the water level in the well when being pumped and the highest point to which the water is lifted, such as the top of the storage tank.

GPD means gallons per day

Table 1

WINDMILL

No windmill is recommended or satisfactory which is not self-oiling and is not equipped with standard quality self-oiling ball roller, removable plain babbitt or bronze bearings or equal. Direct stroke mills will not be used. Wooden wheels are not acceptable without special justification.

Windmill wheel sizes to meet the water requirements of the farm for the estimated depth of water can be determined from Table 1. Be sure to use three times the actual daily water requirement as a basis for determining wheel size.

WELL

All wells should be a minimum of 6 inches in diameter. It is seldom necessary that a well be larger than 8 inches. The hole should be straight and extend well into or through the water bearing sand. The depth will depend upon the location. Average depth of well for any locality can be estimated by talking to a local driller or inquiring as to depth of wells on adjoining farms.

A complete and accurate log of each well should be made recording the different types of soil as well as the depths (measured from normal ground) at which same are encountered. The log should further indicate the depth to water bearing stratum and the distance into the stratum that the well is drilled. Upon completion of drilling, a copy of the log should be forwarded to the Office of the District Engineer.

All wells should be cased their entire depth. For this purpose new steel casing should be used, and the weight per foot for such casing should be not less than the following minimum weights:

6" casing - 13 pounds per foot
8" casing - 17.5 pounds per foot
10" casing - 26.75 pounds per foot

The use of sheet metal casing is not recommended.

In the event that new casing is not available, used oil well casing may be used subject to the following conditions:

1. Bids must be taken on new casing with an Alternate Bid submitted for used oil well casing.

2. Alternate Bids must also show the weight per foot for used casing submitted.

3. All used oil well casing must be rigidly inspected before acceptance,

and must be in first-class condition, free from rust pits and be thoroughly cleansed of all oil and gas residue.

If the casing is set in clay or on rock below the water bearing stratum, perforated joints should be used through the water bearing stratum. If the casing is swung from the surface, it is not usually necessary to use any perforated joints. Screened gravel should be placed around lower end of casing when no perforated joints are used. Gravel should be between 1/4" and 1" in size.

A sand screen may be necessary in some localities. This should be determined by the local driller.

In all cases plans should specify that the driller will set the casing. The estimated cost per foot for drilling the well should include setting the casing. Each contract should state whether the farmer or driller furnishes the casing.

The top of the well should be sealed by means of cement grout around the casing to a depth of not less than 12' below ground surface for sanitary protection and a concrete slab. (See Figure 1). In some localities, it will be found that ground water conditions require the shutting-off of highly mineralized or salt water which may lie above the water stratum to be developed. In which case the cement seal around the casing is carried down to a point below the mineralized or salt water stratum in order to prevent circulation of this unacceptable water into the acceptable water stratum and to protect the casing from the corrosive action of the minerals. The cost of placing this cement seal should be included in the price for drilling and setting casing. The installation of this seal will render unnecessary the use of swing clamps or casing supports. The slab serves as both a seal and a base on which to swing the casing when necessary. The casing should be swung with steel or wooden clamps which are bolted together. Wooden clamps should be made of minimum 4" x 6" material and iron clamps of minimum 1/2" x 3" strap. The casing should extend about 12" above the top of the ground. The concrete slab should be about 6 inches thick. This will allow about 6 inches of casing which can be flared above the slab to hold it. A good practice to follow is to use a steel clamp on the casing and let the clamp rest on the ground. Then pour the concrete around the clamp. After the concrete has set, flare the top of the casing.

TUBING AND FITTINGS

All tubing should be, galvanized plugged and reamed, of standard weight. The size of the tubing should be the next standard size above the cylinder size in order to allow the valves to be withdrawn for repair or replacement of leathers without pulling the pipe.

The tubing should extend 15 feet into the water bearing stratum where possible in order to assure continuous operation. It is realized that often the water bearing stratum may not be this thick. Where such a condition exists, the tubing should extend well into the stratum, five feet or more.

In localities where artesian water is encountered, the tubing should extend 15 feet below the level of the water in the well, as established by a pumping test conducted at the full rated capacity of the equipment to be installed.

The tubing must be suspended by means of some type of clamp. A clamp may be fabricated from 4" x 4" material or ½" or 3/8" steel strap. The most satisfactory method of suspension is a cast iron pipe holder. Such a holder is equipped with set screws to steady the pipe and covers the entire top of the casing. This provides a more sanitary and satisfactory installation since the top of the casing is completely covered. Regardless of the type of clamp used, a coupling, tee or some other fitting should be placed immediately above the clamp and rest on it to carry the weight of the load. (See Figure 1). An asphalt seal is recommended between the pipe holder and the tubing, and the pipe holder and the casing, in order to assure tight joints.

It is recommended that a tee with a ½" or 3/4" opening be used above the clamp and a hose bibb or faucet be attached here. This will provide a place to get drinking water directly out of the well and also a means of draining the riser pipe during cold weather.

It is recommended that the riser pipe be insulated from the ground to a distance of 1 foot above the hose bibb or faucet. This may be done by building a box around the pipe and filling it with sawdust, cottonseed hulls or other suitable material. A short pipe or nipple connection between the faucet and tee may be necessary in this case. The supply pipe from the tank to the ground should also be enclosed in a like manner to prevent freezing. Also, the supply pipe, if located below the ground surface, should be buried below the frost line.

A tee should be placed in the riser pipe approximately 2" or 3" above the elevation of inlet at the top of the storage tank so as to provide ready flow of water to the tank. The riser pipe should extend two or three feet above the tee and be capped, the cap having a hole in it sufficiently large for the sucker rod to operate through. The pipe from the riser to the tank should be the same size as the riser pipe. (See Figure 1).

SUCKER ROD

Wooden sucker rod is recommended. The most common size is 1-3/8". However, 1-1/8" size may be used for a 2" pipe size. Likewise, for

3½" and 4" pipe, 1-7/8" sucker rod is recommended. Galvanized couplings and copper or cadmium plated rivets are recommended in order to protect against possible action of minerals in the water.

WINDMILL TOWER

Wooden towers are preferred. This preference is based largely on two factors: (1) they do not attract lightning as steel towers do and (2) they usually withstand wind in a more satisfactory manner than the commonly used steel towers.

The tower should be of sufficient height that the wheel will be above all surrounding buildings and trees. A 25 or 30-foot tower is recommended. All towers should have platforms of sufficient size to provide a good place to work when the necessity arises. It is recommended that the foundation posts be set in concrete. This provides a more stable tower and reduces the possibility of any settlement if the ground should become saturated around the base of the tower.

Any steel windmill tower to be used must meet the following specifications:

TYPE: Shall be of the four post type of sufficiently sturdy design to withstand a wind pressure of thirty pounds per square foot of projected area of tower and windmill. It shall be furnished completely with ladder securely fastened to tower; substantial platform properly located to permit ready access to motor for repairs and upkeep work; pump pole; long anchor posts and substantial anchors; and complete instructions for erections. The steel shall comply where applicable with Federal Specifications QQ-A-75la for grade C structural steel.

SIZE: The towers shall be classified according to the following heights and spread at base:

Class	B-20	B-30	B-40
Height	20'	30'	40'
Spread at base (minimum)	4'	6'	8'

GIRTS: shall be of angle steel or adquate cross-action to give proper stability to the tower specified and spaced approximately 5 feet apart.

BRACES: Tower shall be adequately braced to prevent twisting or deformation of the tower members. The braces shall be adjustable or capable of giving uniform tension at all times.

GALVANIZING: All structural parts of the tower shall be heavily galvanized or otherwise treated in an approved manner to resist rust and weather. The galvanizing shall be not less than 2 ounces per square foot of area in accordance with A. S. T. M. Standard A-93-38T or Federal Specifications QQ-I-696 where applicable for Type II, Class C Steel and the test of Galvanizing shall be by the triple spot test.

PUMP POLE GUIDES: Tower shall be equipped with sufficient pump pole guides to keep the pump pole in proper alignment without binding or interfering with the action of the rod. Patented guides may be used. Bill of materials shows 2" x 6" used as guides.

STORAGE TANKS

It is recommended that the minimum tank provided be a 50-barrel or 1500-gallon capacity. The tank should have a minimum capacity equal to 1½ to 2 times the daily water requirement. This minimum can be reduced only when supplemental storage equivalent to the stock needs for 7 to 10 days is available.

Cypress or Redwood tanks are recommended in all cases. They are longer lived, not being susceptible to corrosion from minerals in the water, and keep the water much cooler than steel tanks. In all cases, they should be covered. The cover prevents the drying out of the upper portion of the tank when the water remains low for a few days and keeps the water clean. Tank dimensions may be determined from Table 2 for water requirements. Tanks below 90 barrel capacities should have 1½" staves and 1½" bottoms. For tanks with capacities from 90 to 150 barrels, 2" bottoms and 1½" staves should be used.

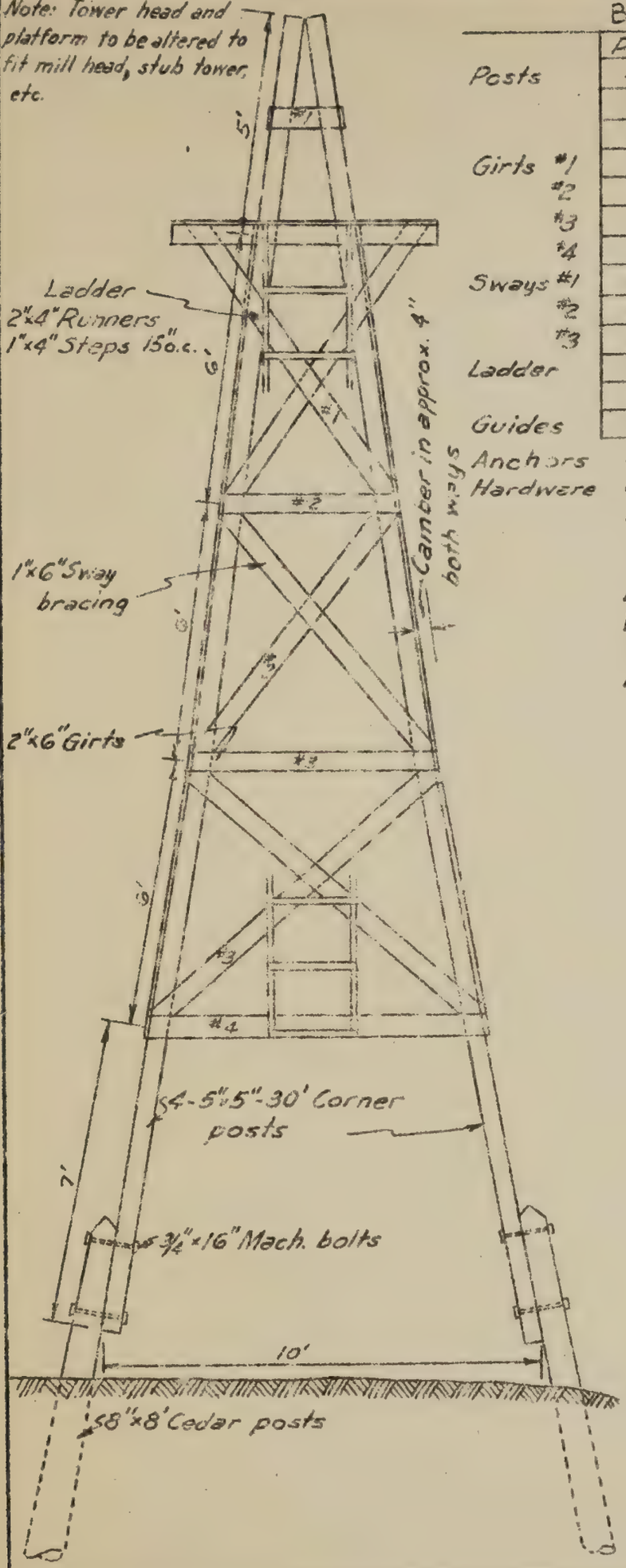
Galvanized sheet metal or wood fabricated tops must be procured for these tanks. Fabricated wood tops may be built on ½ pitch and with five or six slopes. See Figure 8 for suggested specifications. Such wood tops are recommended only when the farmer can build them himself. Sheet metal tops are obtainable from most tank manufacturers.

In all cases where wood tanks are used, the bottom of the tank should rest firmly on the joists of the tower. No weight of the tank should be supported by the rim which extends below the tank bottom. Filler screeds or bottom supports (2" x 2" material) must be placed for tank bottom support so that weight is carried by tank bottom and not by sides. These screeds should be placed on about 12-inch centers. Screeds do not show in Bills of Material, but must be calculated for each size of tank.

STORAGE TANK TOWER

Only wood towers are recommended. They should be strong enough to hold the storage tank and water for the maximum anticipated installation.

Note: Tower head and platform to be altered to fit mill head, stub tower, etc.



BILL OF MATERIALS

	Pcs.	Dimensions	Grade	F.B.M.
Posts	4	5"x5"x30'		250
	6	2"x6"x 6'	#1 S4S	36
	6	1"x12"x 6'	#2 Boxing	36
Girts #1	6	2"x6"x 2'	#1 S4S	12
#2	4	2"x6"x 4'	"	16
#3	4	2"x6"x 6'	"	24
#4	4	2"x6"x 8'	"	32
Sways #1	4	1"x6"x16'	#1 Rough	32
#2	4	1"x6"x16'	"	32
#3	4	1"x6"x18'	"	36
Ladder	2	2"x4"x20'	#2 S4S	27
	2	1"x4"x16'	#1 S4S	11
Guides	2	2"x6"x 6'	"	12

Anchors 4 cedar posts 8"top 8'long

Hardware 8-3/4"x16" machine bolts

Nails

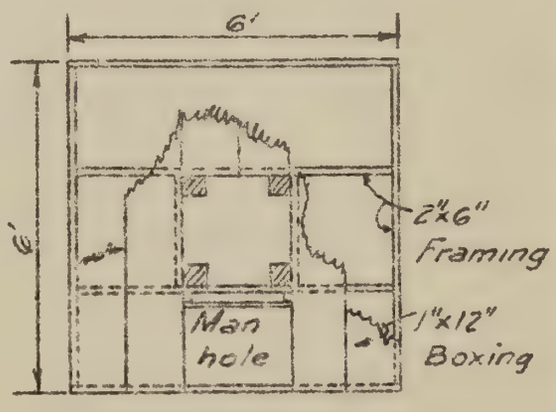
8d	3 lbs.	Ladder
16d	8 "	Sways
20d	10 "	Girts & Ladder

Washers

5/4" Flat wrought 3 lbs.

Paint

3 gals mixed, barn.



PLATFORM

F. S. A. DALLAS, TEXAS	30 FT. WOOD WINDMILL TOWER	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 SEPT. 1942

FIG. 3

Note: Tower head and platform to be altered to fit mill head, stub tower, etc.

BILL OF MATERIALS

	Pcs	Dimensions	Grade	F.B.M
Posts	4	5"x5"x25'		208
	6	2"x6"x 6'	#1 S4S	36
	6	1"x12"x 6'	#2 Boxing	36
Girts #1	6	2"x6"x 2'	#1 S4S	12
#2	4	2"x6"x 4'	"	16
#3	4	2"x6"x 6'	"	24
Sways #1	4	1"x6"x 16'	#1 Rgh	32
#2	4	1"x6"x 18'	"	34
Ladder	2	2"x4"x 20'	#2 S4S	27
	2	1"x3"x 16'	#1 S4S	11
Guides	2	2"x6"x 6'		12

Anchors 4 cedar posts 8" top 8' long

Hardware 8 3/4"x16" Machine bolts

Nails

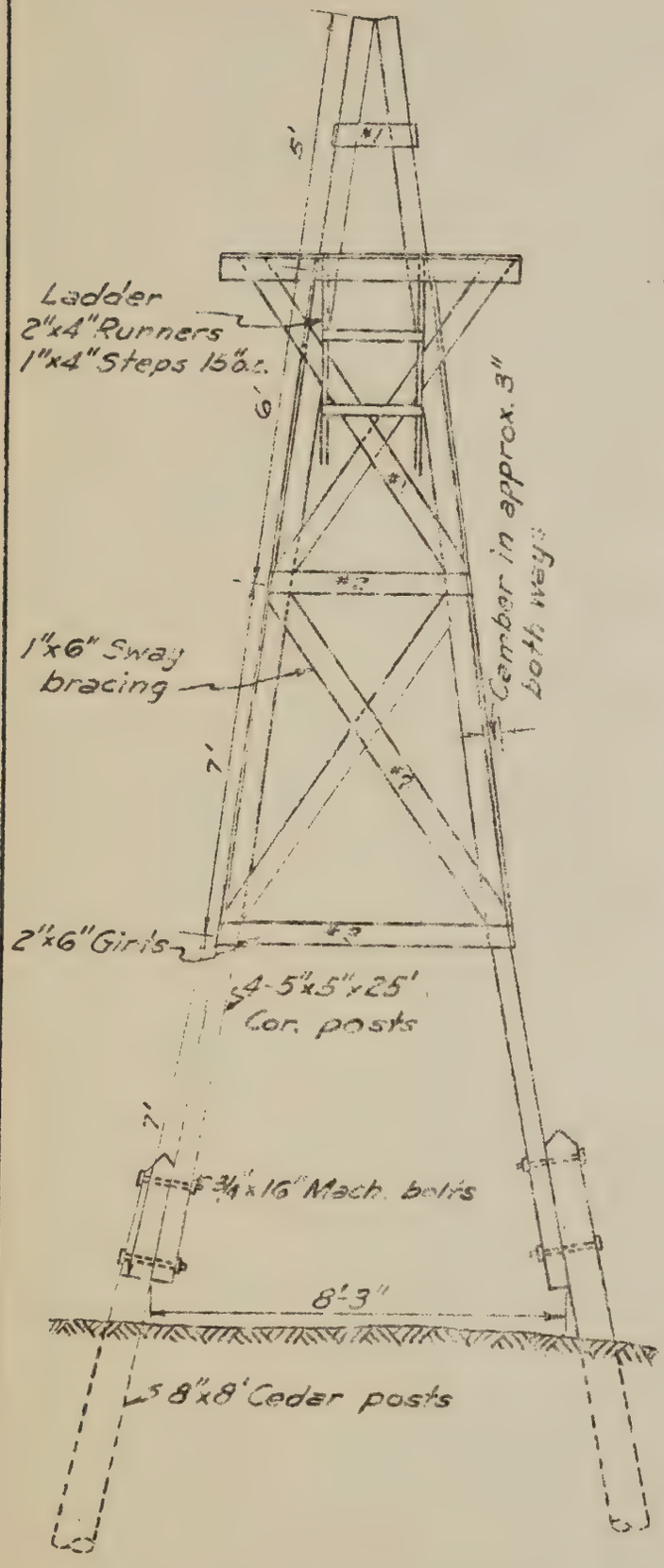
8d	2 lbs.	Ladder
16d	6 "	Sways
20d	8 "	Girts & Ladder

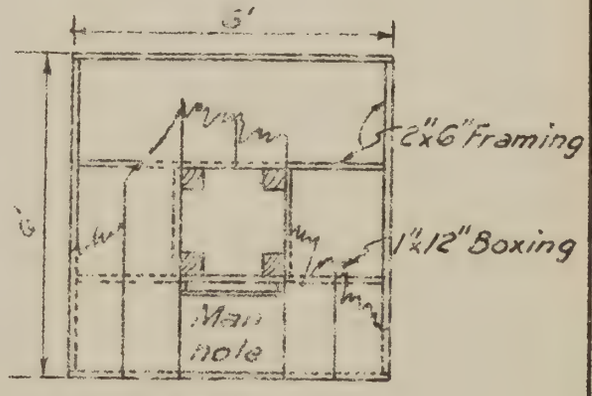
Washers

3/4" Flat wrought 3 Lbs.

Paint

2½ gals. mixed, barn.





PLATFORM

F. S. A. DALLAS, TEXAS	25 FT. WOOD WINDMILL TOWER	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 SEPT. 1942

FIG. 4

TABLE 2

STORAGE TANK CAPACITIES

Outside Length Staves Feet	Outside Diameter Bottom Feet	CAPACITY in Gals.	CAPACITY in Bbls.
6	7	1516	48
6	8	2000	63
7	7	1735	56
7	8	2352	74
7	9	3000	95
7	10	3723	118
8	8	2705	86
8	10	4282	136

TABLE 3

STOCK TANK CAPACITIES

Outside Length Staves Feet	Outside Diameter Bottom Feet	CAPACITY in Gals.	CAPACITY in Bbls.
2	4	150	5
2	5	221	7
2	6	324	10
2	7	446	14
2	8	588	19
2	10	931	30
2	12	1550	49
2	14	2000	64
2	16	2500	80
2½	6	421	13
2½	7	580	18
2½	8	764	24
2½	10	1210	38
2½	12	1758	55
2½	14	2226	71
2½	16	2835	90

These tables taken from Axtell Catalog and were computed for wood tanks.

This policy is adopted in order that future storage requirements may not be limited by an inadequate tower.

Tower heights should be a minimum of ten feet. In all cases, the top of the tower should be 6 feet higher than the highest outlet in the water line. Footings for the tower should be made of concrete and the columns either set in the concrete or bolted to it. If the columns are bolted down, ⅛" x 3" straps or angles and 3/4" bolts should be used.

It is recommended but not required that the tower be enclosed to form a milk and wash house. In this case, a concrete floor with drain should be provided and milk box installed. See Figures 6, 9 and 10. Drains from milk house and milk box should go to garden irrigation system.

TREATMENT OF REDWOOD TANKS

DISCOLORATION FROM REDWOOD - All woods contain certain substances that will discolor the water in a tank when first used, but will wash out with normal use. This is true of most woods, but due to the darker color of the Redwood, it is more noticable. This discoloration is not harmful; however it can be eliminated by washing the tank out with a sal soda solution as described in the paragraph below.

BLEACHING - To successfully prevent Redwood from coloring the water or other liquids, it is necessary to bleach the color out of the wood by using about 5 pounds of sal soda to every 1000 gallons of tank capacity. Place these crystals in a container in the bottom of the tank and dissolve them by running almost boiling water from a slow running garden hose. After filling the tank, allow the solution to stand for 48 hours, drain the tank and wash the sides and bottom thoroughly with cold water under pressure, then refill the tank with cold water and allow to remain for 24 hours. After being drained this time, it is ready for use.

COATING THE INTERIORS OF TANKS - Interior coatings such as paraffin and various forms of commercial wax adhere most readily to Redwood because its uniform texture and freedom from oils and resinous matter allow these coatings to penetrate evenly and uniformly. The small amount of shrinkage and expansion tend to insure a good bond and better protection for the coating at the joints. The coatings mentioned above are usually employed when certain acids, fruit juices, extracts and similar solutions are to be stored.

PAINTING THE EXTERIOR OF WATER TANKS - It is important to follow special practices if water and sprinkler tanks located on the exterior of buildings where they are exposed to the elements are to be painted

successfully. This is not necessary because of the character of the wood, but rather the condition of the usage. The staves are subject to various moisture conditions and extreme conditions. If a tight paint film is used, moisture may become entrapped beneath the paint film, and the entrapped moisture in a change of temperature creates a vapor pressure that causes a blister in the paint coating. When this blister bursts, it causes the paint to begin to flake and if enough moisture has collected to run, it is likely to stain.

PROPER METHOD PAINTING THE EXTERIOR - The proper and most successful method of painting exteriors of water tanks is to use any good type of flat, porous paint which will permit a breathing action from the tank's surface. High-grade creosote stains in the desired color may also be used. If signs or letters are wanted on the tank, either stamped or painted aluminum figures may be used. The aluminum should be protected with a thin coat of varnish or a good paint of any desired color.

SUPPLY PIPE FROM STORAGE TANK

This should be a 2" pipe which extends from the tank into the ground. All exposed portions of the pipe should be insulated with standard wool felt sectional pipe insulation.

Where the tank tower is enclosed to provide a milk house, a valve should be protected above the first take-off which will be to the milk box. The milk box pipe should be 3/4" and should be provided with a hose bibb or a valve to regulate the flow.

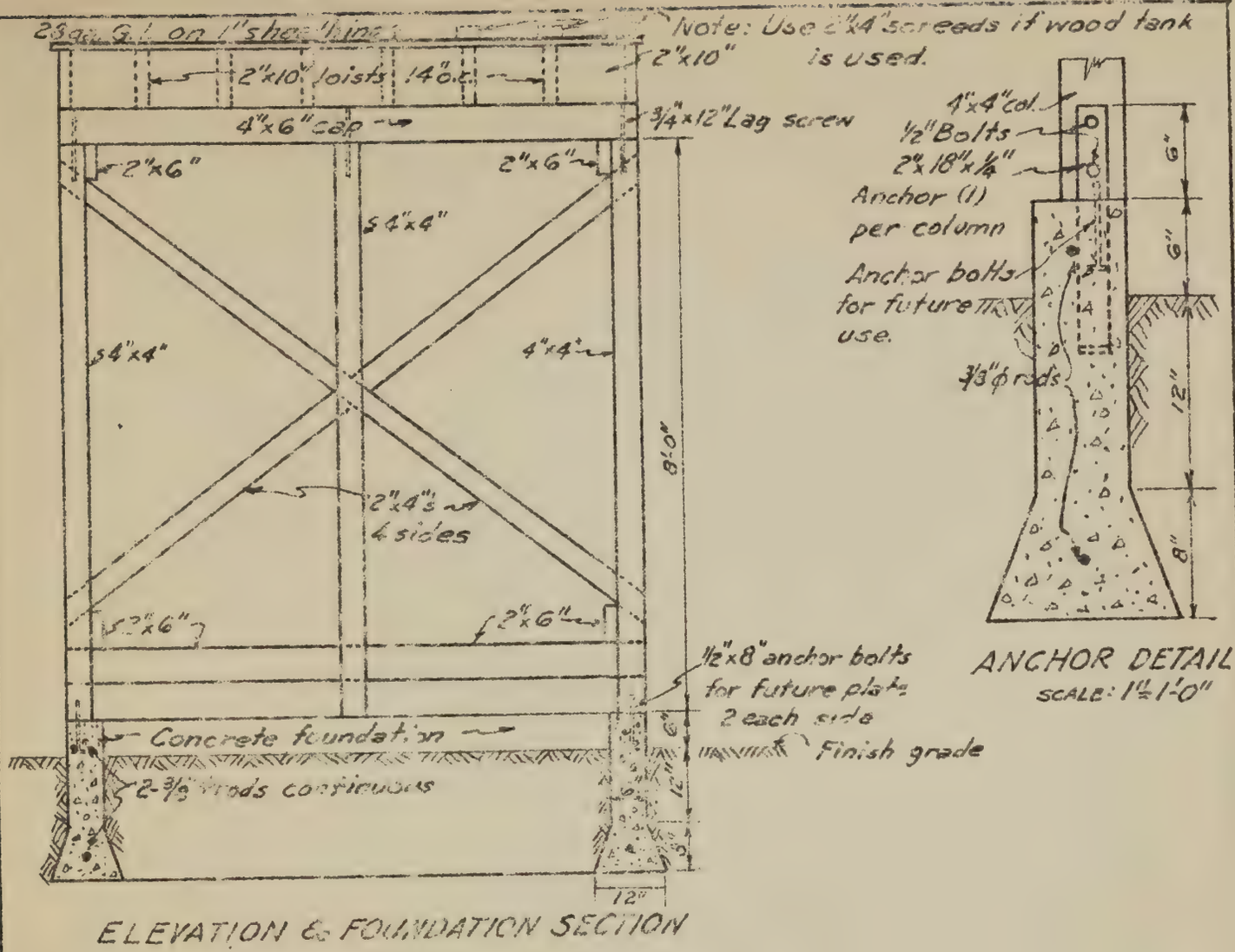
Also within the milk house, there should be an outlet for the washing machine and tubs. If the tubs are stationary, a 3/4" pipe should be run to their location or a hose may be attached to the hose bibb on the milk box outlet to fill the tubs.

The supply pipe should pass through the milk house floor near the wall. This will reduce the inconvenience of any necessary repair on the section of the line under the floor. The ell used under the floor on the outlet pipe can be a reducing ell from 2" to 1¼".

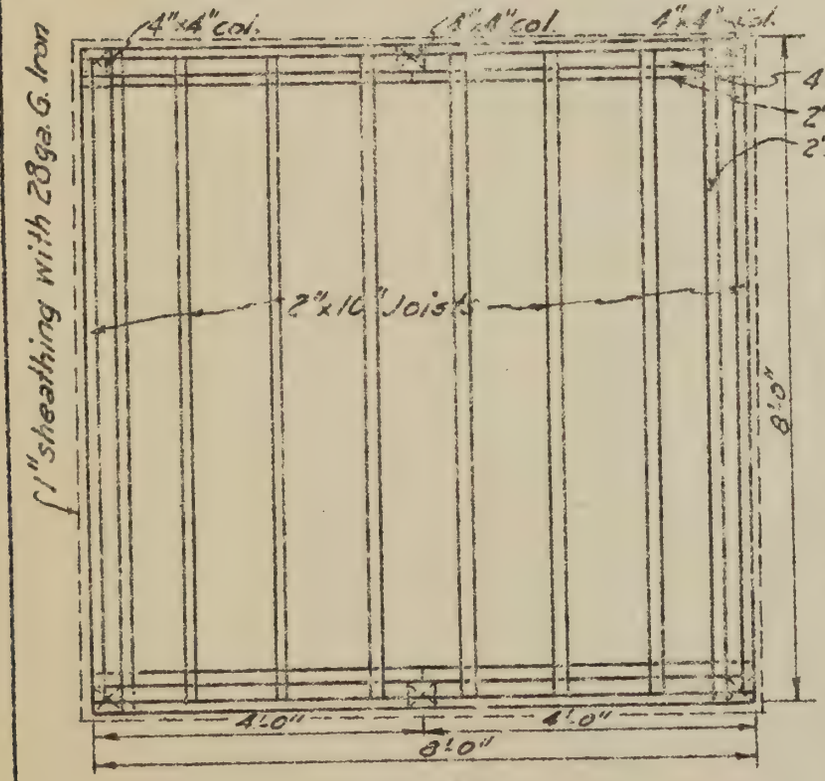
The overflow pipe from the tank should be arranged to discharge into the milk box. The overflow pipe from the milk box may be arranged to extend horizontally through the milk house wall at the proper level to spill into a small surface earth reservoir approximately 20' x 30' which may be used for garden irrigation.

LEAD PIPES

All pipes leading to house, barn, or stock tanks must be at least 20 inches under the ground to assure protection from freezing.



ELEVATION & FOUNDATION SECTION



PLAN
SCALE: 3/8"=1'-0"

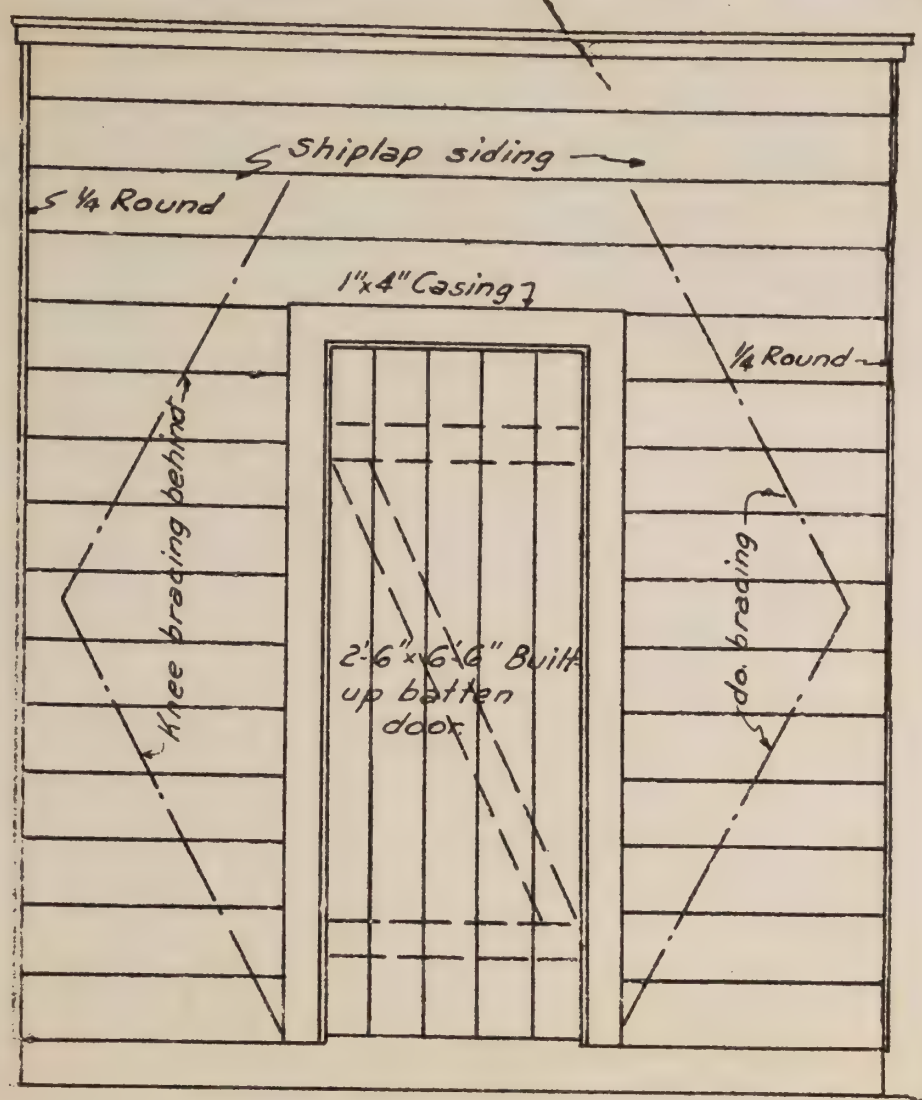
BILL OF MATERIALS

QUANTITY	ITEM
3	1/2" ϕ Bolts, nuts & washers
4	2"x18"x1/4" Anchors
6	4"x4"-8'-0" Columns
10	2"x10"-8'-0" Joists
2	4"x6'-8'-0" Caps
6	2"x6"-8'-0" Hor. braces
8	2"x4"-10'-0" Diag. braces
68 S.F.	1" Sheathing
68 S.F.	28 Ga. galvanized iron
64 L.F.	3/8" ϕ Reinforcing steel
8	1/2"x8" Anchor bolts
6	3/4"x12" Lag screws
	Nails
1.5 sks	Cement
0.7 c.y.	Sand
1.2 c.y.	Stone

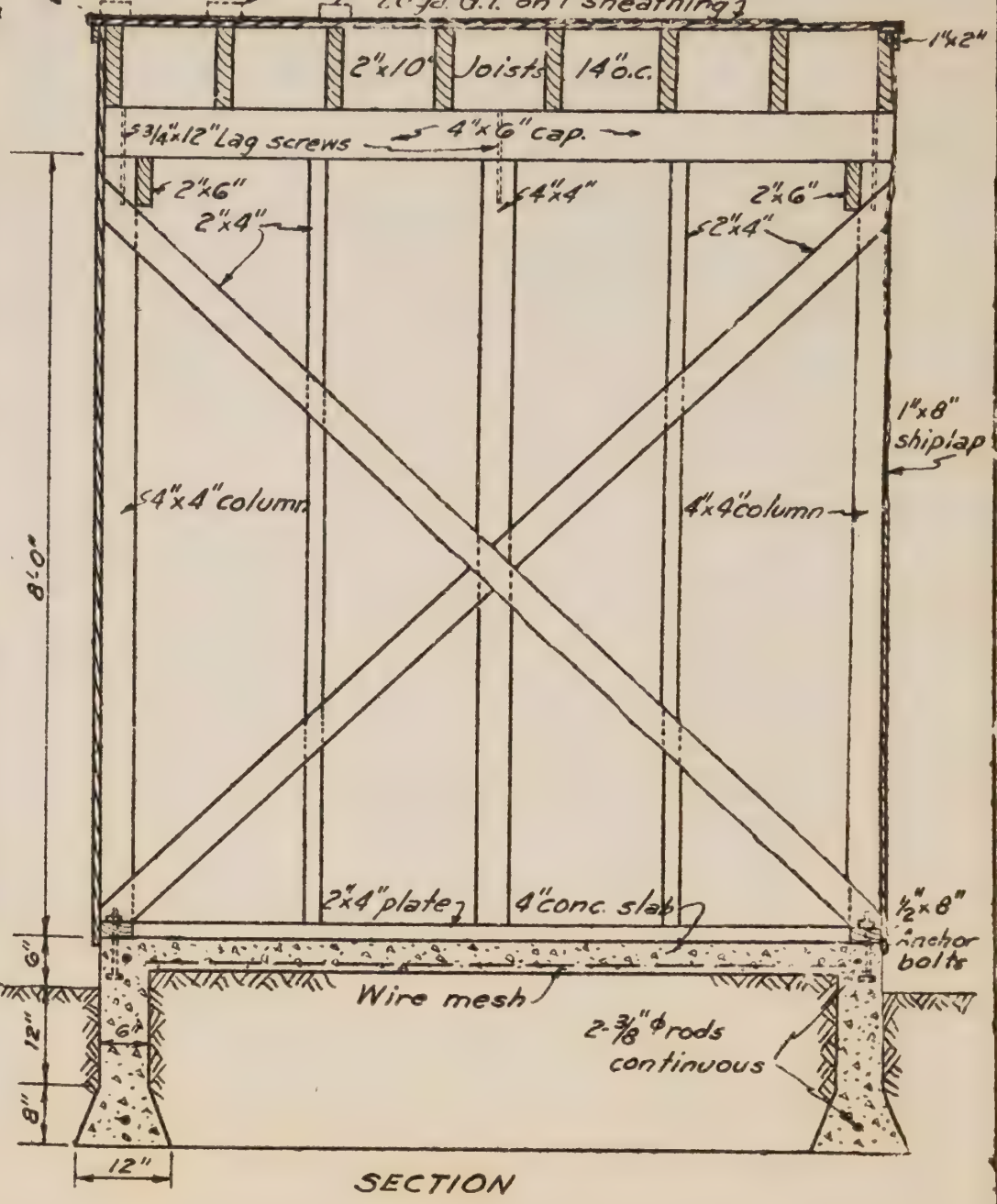
F. S. A. DALLAS, TEXAS	WATER TOWER FOR MAXIMUM TANK CAPACITY OF 56 BBLS.	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 SEPT. 1942

FIG. 5

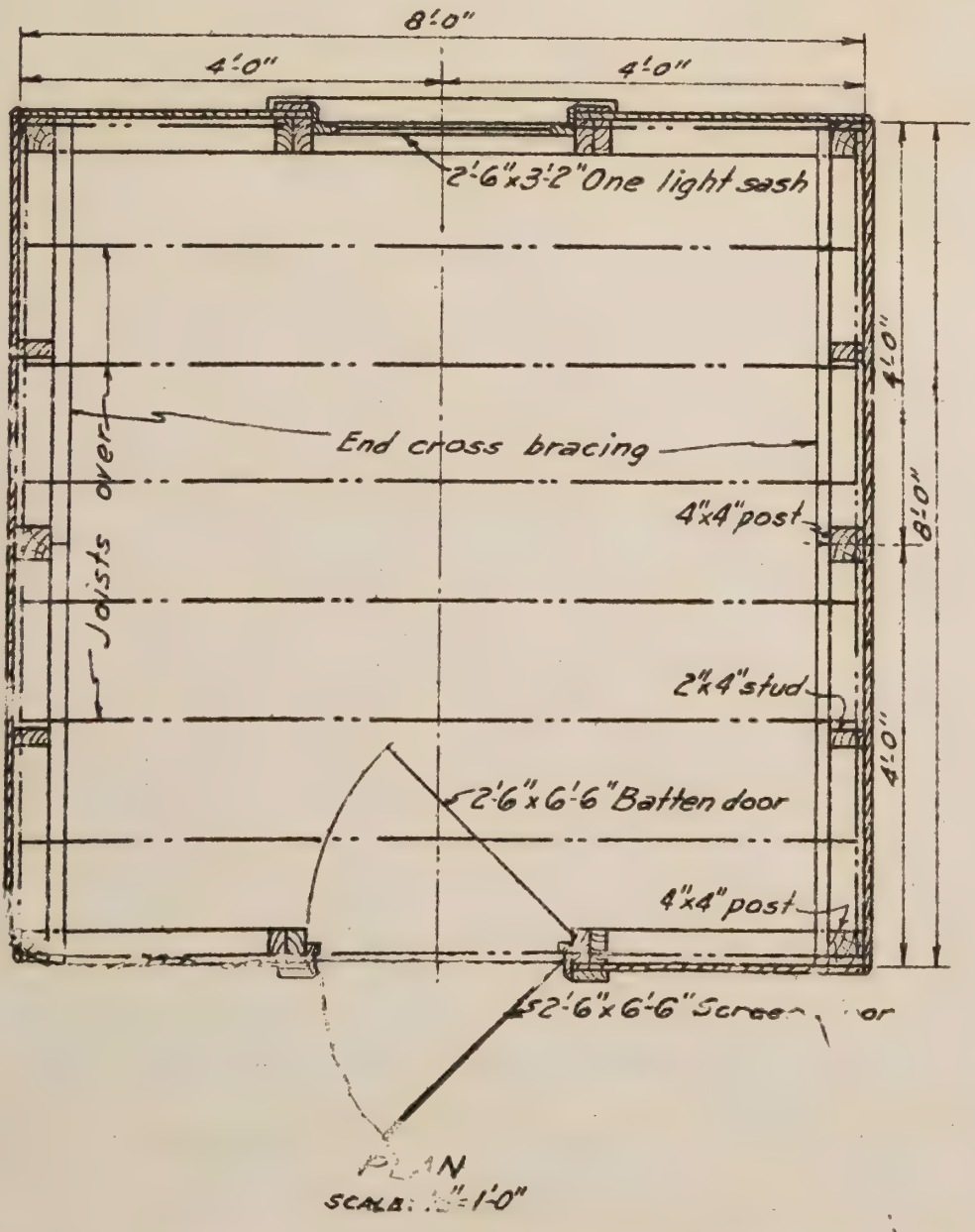
Note: Use 2"x4" screeds if wood tank is used



ELEVATION



SECTION

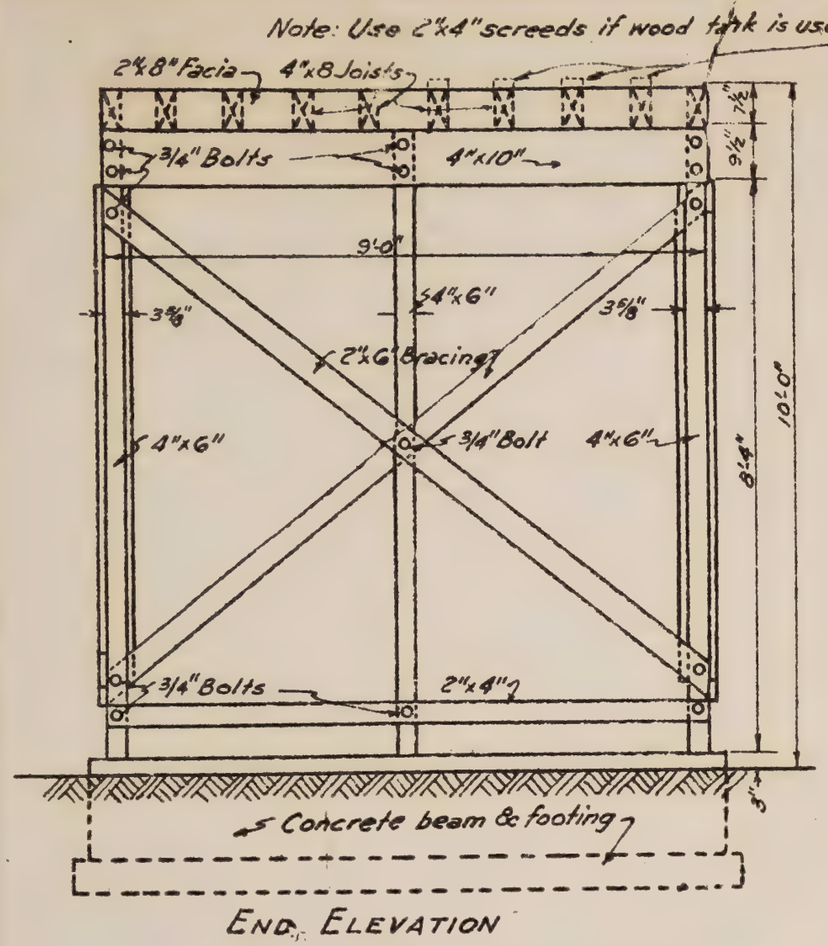


PLAN
SCALE: 1/2"=1'-0"

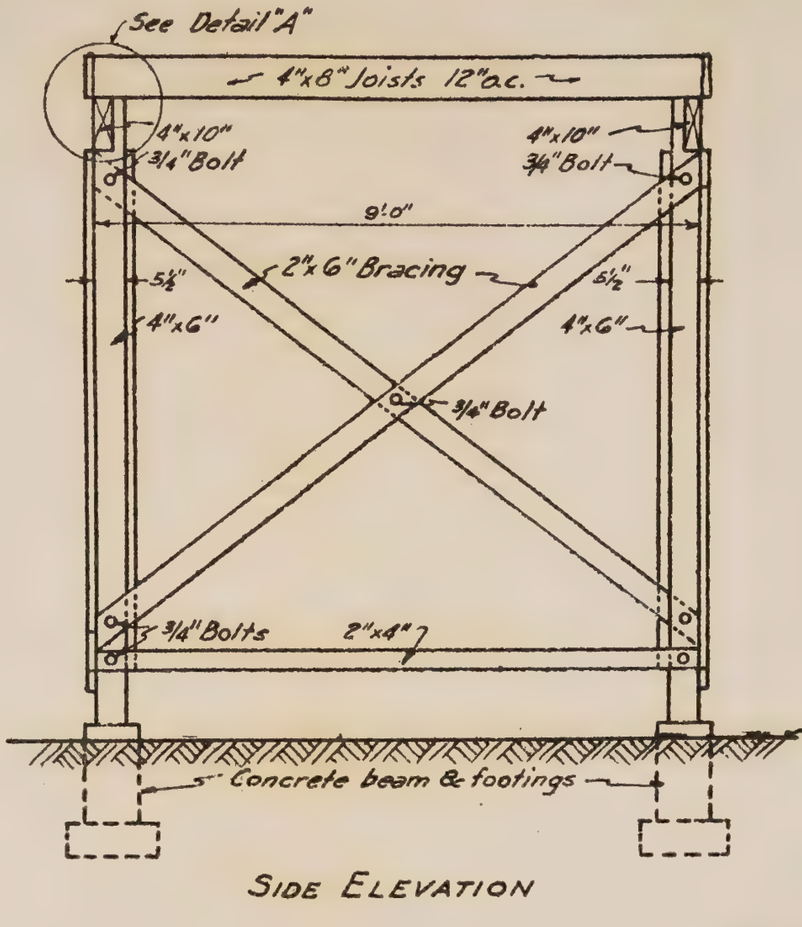
BILL OF MATERIALS

Quantity	Item
6	4"x4"-8'-0" Columns
12	2"x4"-8'-0" Studs
4	2"x4"-10'-0" Cross braces
8	2"x4"-3'-0" Knee braces
4	2"x4"-3'-0" Door & window headers
4	2"x4"-8'-0" Plates
1	2"x6"-3'-6" Window sill
10	2"x10"-8'-0" Joists
2	4"x6"-8'-0" Caps
100 L.F.	1"x2" Facia, door & window stops
30 L.F.	1"x4" Exterior door & window casing
32 L.F.	3/4" Quarter round
256 S.F.	1"x8" Shiplap siding
64 S.F.	1" Roof sheathing
68 S.F.	28 Ga. galvanized iron roofing
64 L.F.	28 Ga. galvanized iron roofing
49 S.F.	6"x6" Reinforcing wire mesh
8	1/2"x8" Anchor bolts
6	3/4"x12" Lag screws
1	2'-6"x6'-6" Built up batten door
1	" " Screen door
1	2'-6"x3'-2"x1 3/8" 12 Lt. window sash (hinged)
1	" " Window screen
	Nails, screws & hinges

F. S. A.
DALLAS, TEXAS
ENCLOSED WATER TOWER
FOR 56 Bbl.
OFFICE OF
DISTRICT ENGINEER
DISTRICT No. 5
SEPT. 1942



END ELEVATION



SIDE ELEVATION

BILL OF MATERIALS

QUANTITY	ITEM
6	4"x6"-9'-1½" Columns
2	4"x10"-9'-0" Caps
10	4"x8"-9'-0" Joists
8	2"x6"-12'-0" Diagonal braces
4	2"x4"-9'-0" Horizontal braces
42	¾" Bolts
84	2" Sq. washers
6	4"x24"x¼" Anchor plates
12	½" ϕ Anchor bolts
12	1½" ϕ Washers
20	⅜"x12" Lag screws
7.5 sks	Cement
0.7 c.y.	Sand
1.1 c.y.	Stone
2	2"x8"-9'-0" Facia

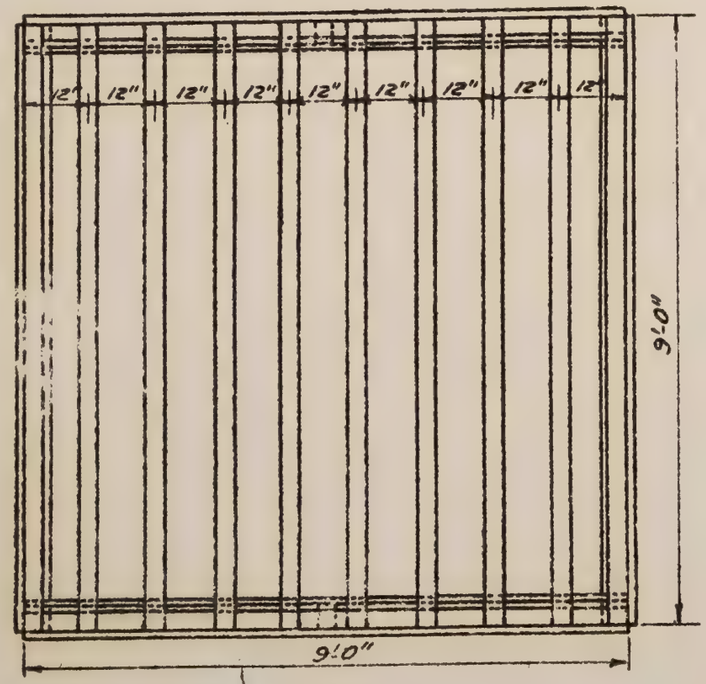
GENERAL NOTES:

3½ gallons of paint required.

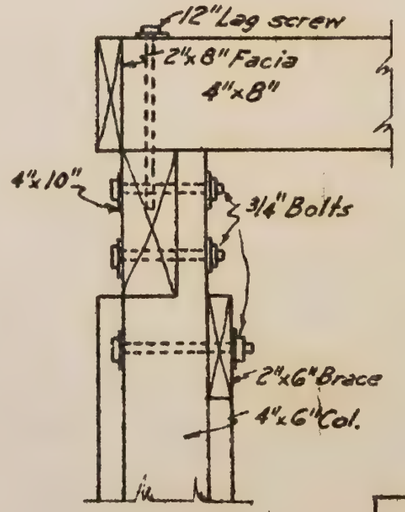
If metal tank is used floor over joists with 2"x6" spaced ½" apart & omit 2"x4" used on top of joists under.

All lumber to be S4S No 1 Yellow Pine or Fir.

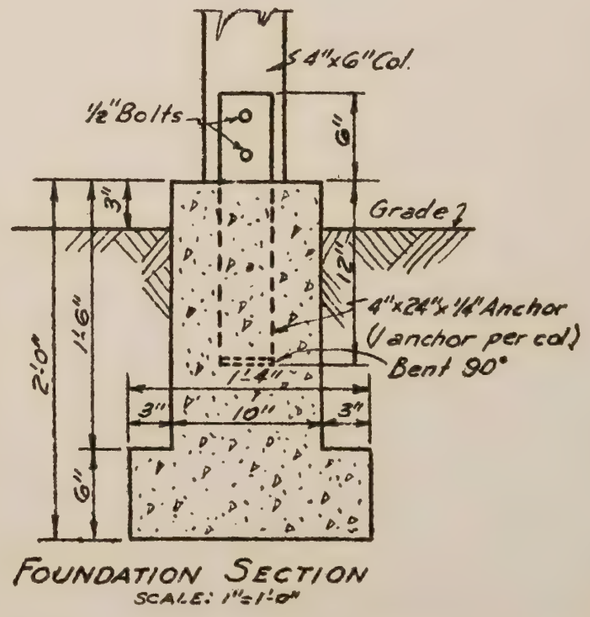
Use 6 gallons of water per sack of cement in mixing concrete.



PLAN
SCALE: ⅜"=1'-0"



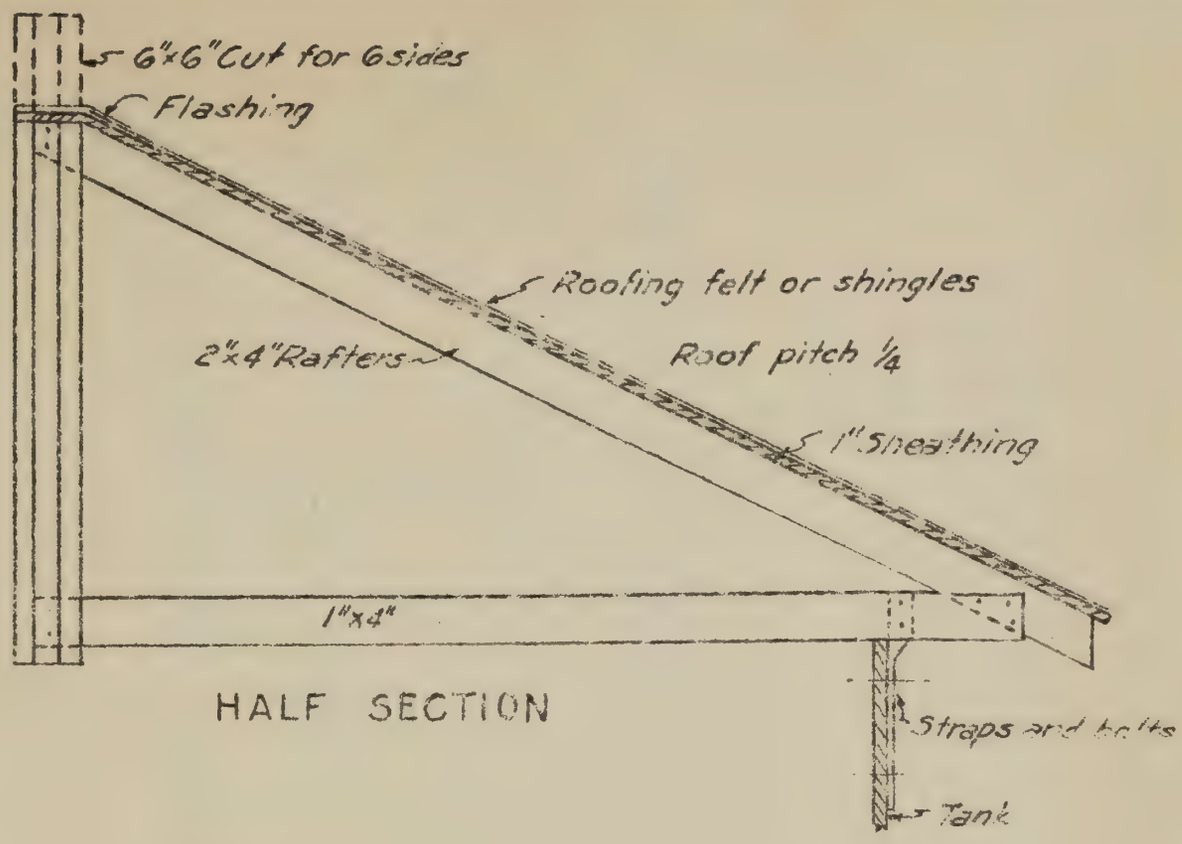
DETAIL "A"
SCALE: 1"=1'-0"



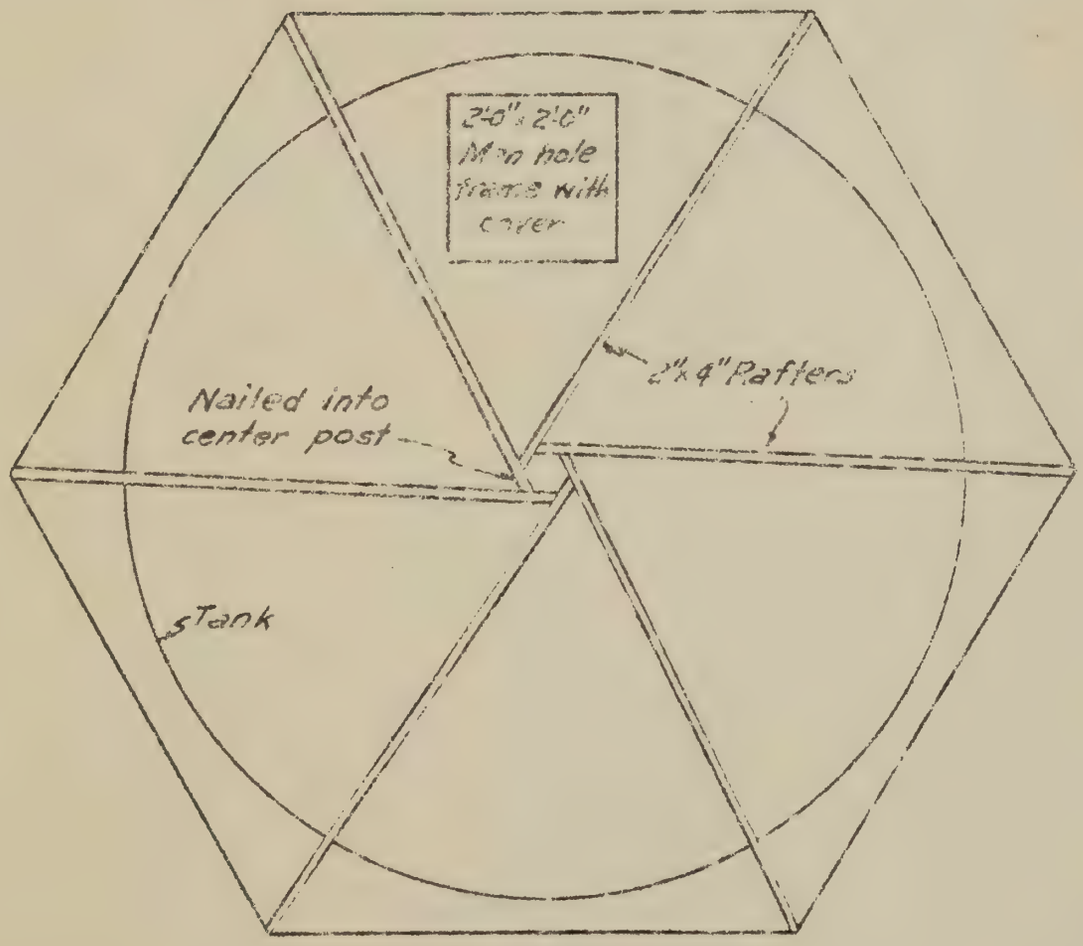
FOUNDATION SECTION
SCALE: 1"=1'-0"

F. S. A. DALLAS, TEXAS	WATER TOWER FOR MAXIMUM TANK CAPACITY OF 80 BBLS.	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 SEPT. 1942

FIG. 7



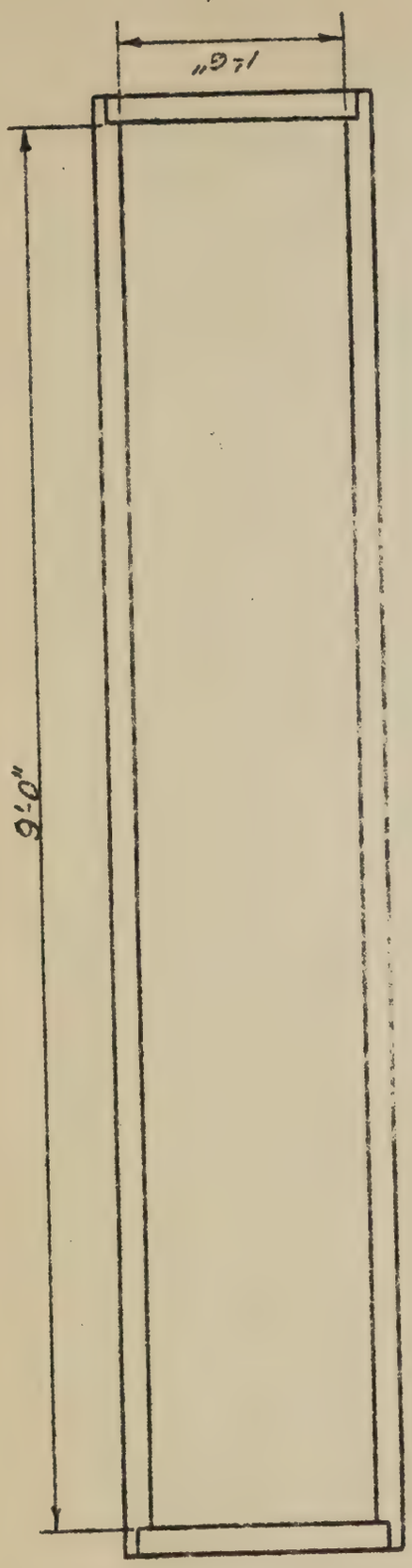
HALF SECTION



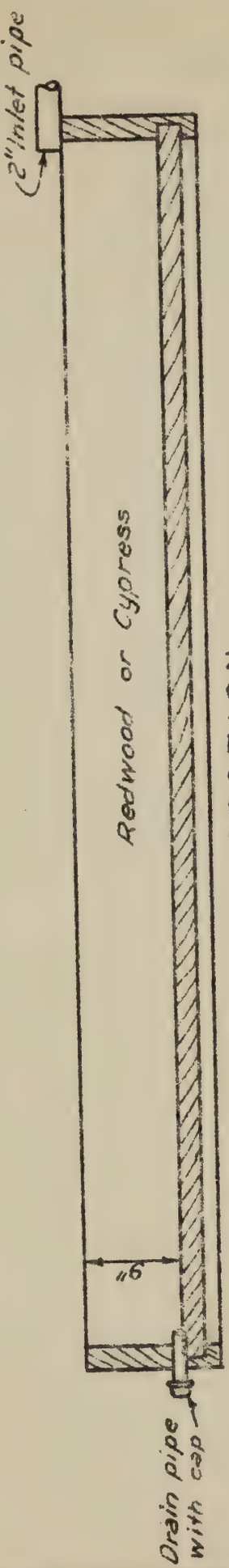
PLAN

F. S. A. Dallas, Texas	Fabricated Top For Wood Storage Tank	Office Of District Engineer District No 5 Aug. 1942

Fig. 8



PLAN



SECTION

SCALE: 3/4"=1'-0"

BILL OF MATERIALS

PART	No. Pc.	SIZE
Bottom	1	2" x 2'-0" x 9'-2"
Ends	2	2" x 1'-0" x 1'-8"
Sides	2	2" x 1'-0" x 9'-4"

F. S. A.
DALLAS, TEXAS

WOODEN COOLING TROUGH

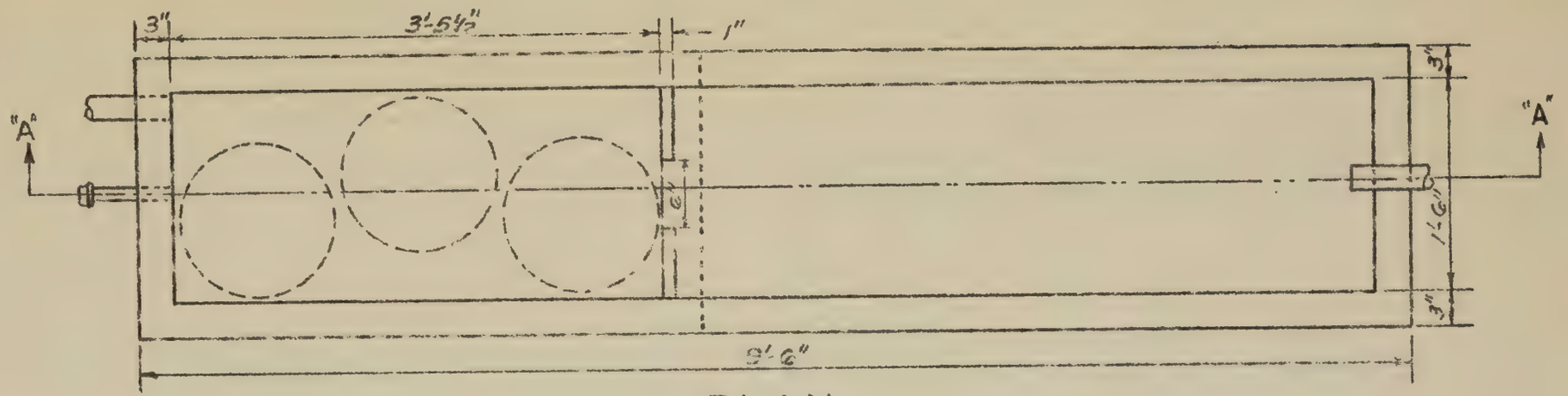
OFFICE OF
DISTRICT ENGINEER
DISTRICT No5
AUG. 1942

FIG. 9

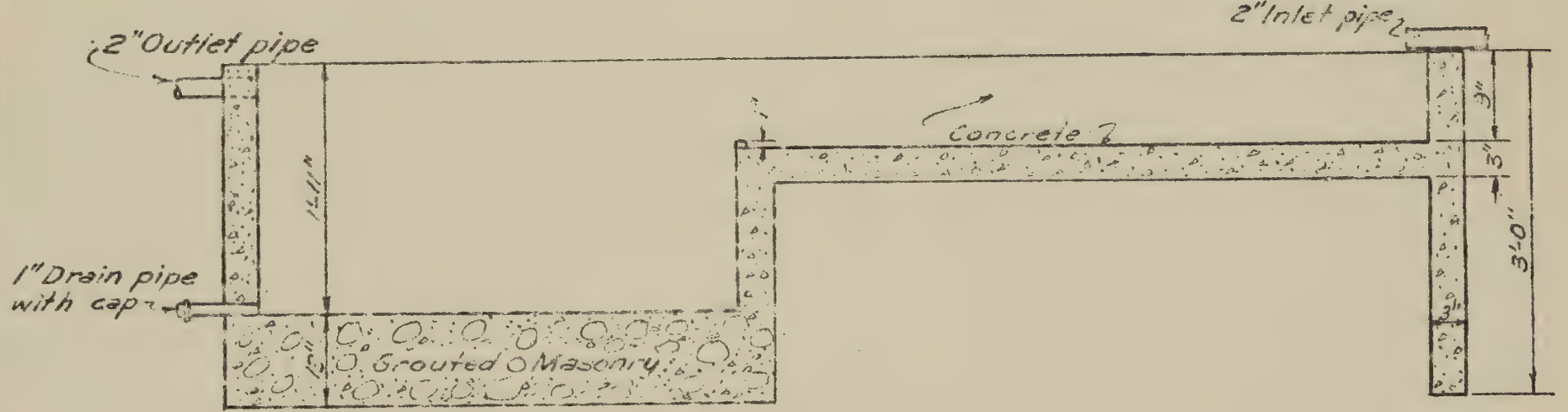
F. S. A.
DALLAS, TEXAS

CONCRETE COOLING TROUGH

OFFICE OF DISTRICT ENGINEER
DISTRICT No 5
AUG. 1942



PLAN



SECTION "A-A"

BILL OF MATERIALS

Cement	3.6 sacks
Sand & Stone	0.7 cu. yd.

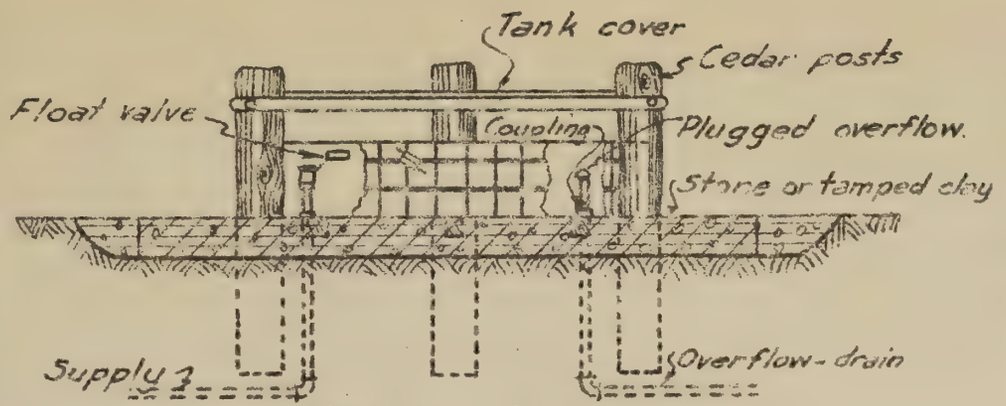
FIG. 10

F. S. A.
DALLAS, TEXAS

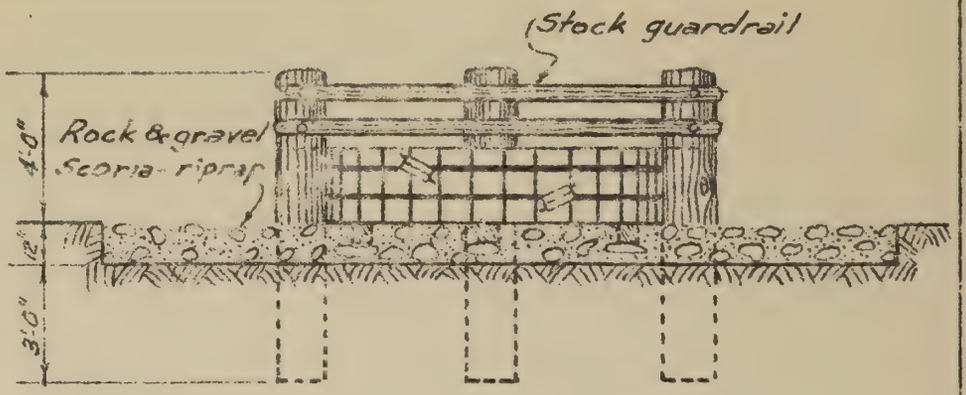
CATTLE WATERING TANK

OFFICE OF
DISTRICT ENGINEER
DISTRICT No5
AUG 1942

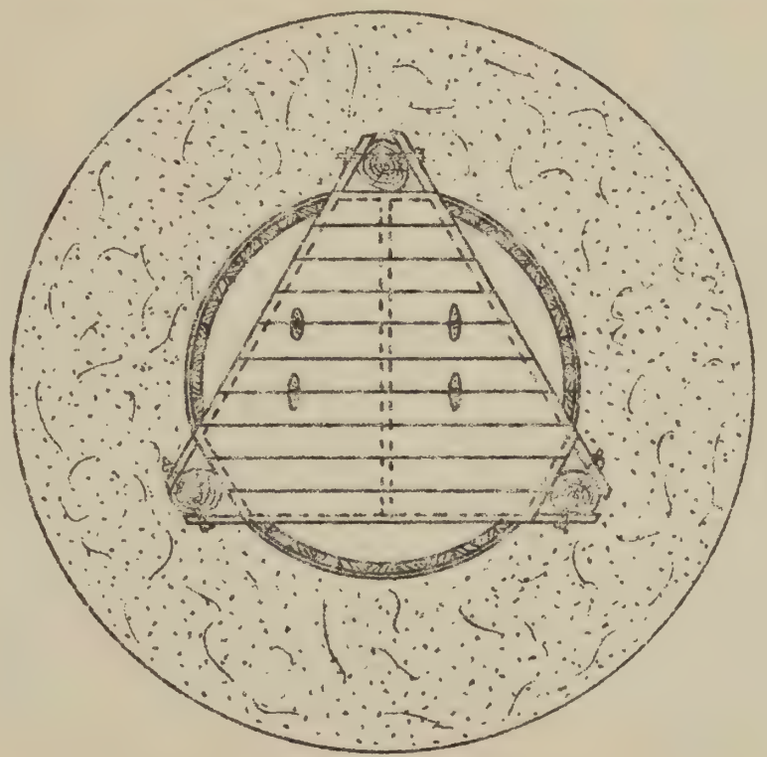
FIG. 11



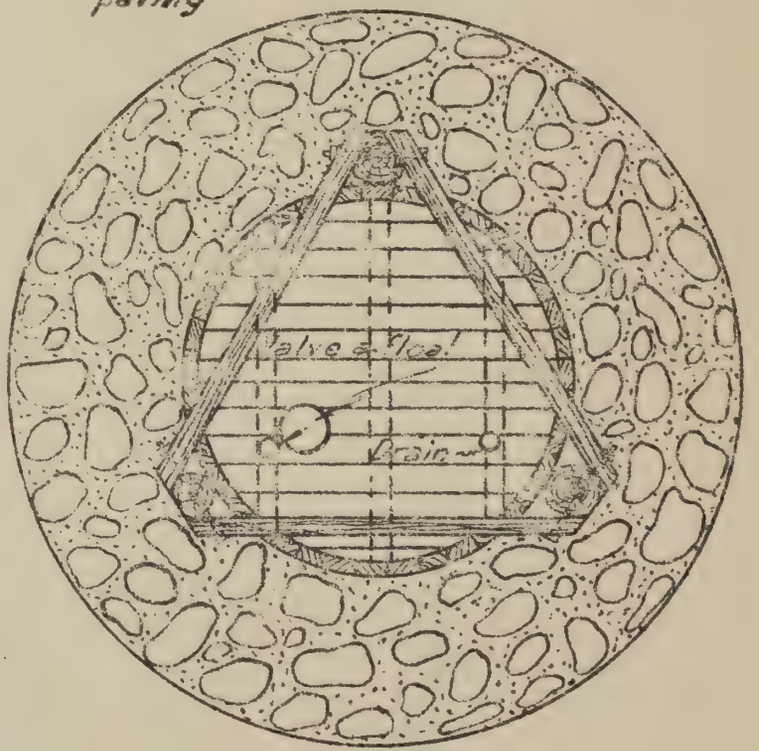
Elevation of Tank
Showing cover, plumbing, supports & paving



Elevation of Tank
Showing guardrail, supports & alternate paving



Top View of Tank



Top View of Tank

The lead pipe to the house should be 1½". Any desired take-offs from this pipe for hydrant, stock tank, or other outlets should be provided for by proper fittings such as reducing tees at the desired location. Such hydrants or other outlets which tie onto the house lead pipe should be provided with individual valves, preferably of the stop and waste type. All garden hose or irrigation hose require a 3/4" hose bibb.

The pipe size should be reduced to 3/4" at the house. Immediately after the reduction, a stop and waste should be installed to control the entire house water system.

STOCK TANK

Either wood, metal or concrete tanks are recommended. Each tank should have a capacity equal to 5 times the daily water requirement of the stock to be watered there unless excessive storage is provided elsewhere.

A cover for stock tanks similar to that shown in Figure 8 is recommended. This keeps animals and chickens from getting into the tank and keeps the water cleaner.

All tanks should be supplied by a 1" to 1½" pipe, depending on the distance from the storage tank to the stock tank. It is recommended that a 1" pipe be used only on distances less than 100 feet.

A float valve should be a part of each tank installation. This provides for economical use of water and assures water in the stock tank at all times when available from the storage tank. Each tank should have a drain plug. For capacity of various size tanks, see Table 3.

GARDEN IRRIGATION TILE

When desired, overflow from the milk box and the milk house floor drain can be piped into sub-irrigation tile in the garden. These tile can be made by using specifications and forms available in high school farm shop classes. The tile should be laid in rows below plow depth and the rows spaced about twice the ordinary spacing of the garden rows apart. The tile should be about ½" to 1" apart in the rows and the broken joints covered with tar paper. If there is much demand for these tile, arrangements should be made with the local high school farm shop instructor to have the forms made in the shop. The cost is prohibitive unless tile can be made by the farmer.

CONCRETE

All concrete used for bases and foundations should be of a 1:2:4 mix. The mix requires 5 sacks of cement, 10 cu. feet of sand and

20 cu. feet of gravel for each cubic yard of concrete.

Special care should be exercised in the mixing and placing of concrete for watertight structures, such as for stock tanks or cooling troughs. In that the requirement for these structures is small, the concrete may be mixed by hand methods. Sand and gravel should be measured according to the mix hereinbefore mentioned and placed on the mixing board. The cement should then be spread over the material and dry mixed until the cement is thoroughly mixed with the material. Water should then be added, and the mixing continued until the materials are thoroughly destributed and a plastic and workable mix obtained. The quantity of mixing water required will vary according to the moisture contained in the sand and gravel, but should not exceed six gallons of water for each sack of cement.

After the mixing operation the concrete should be immediately deposited in the forms and continuously deposited until the structure is complete. As the concrete is deposited it should be spaded or tamped through successive layers and next to the forms to insure a consolidated mass free from segregation. After the concrete has sufficiently hardened (usually the following day) the forms should be removed and the concrete cured by covering and wetting for a period of several days.

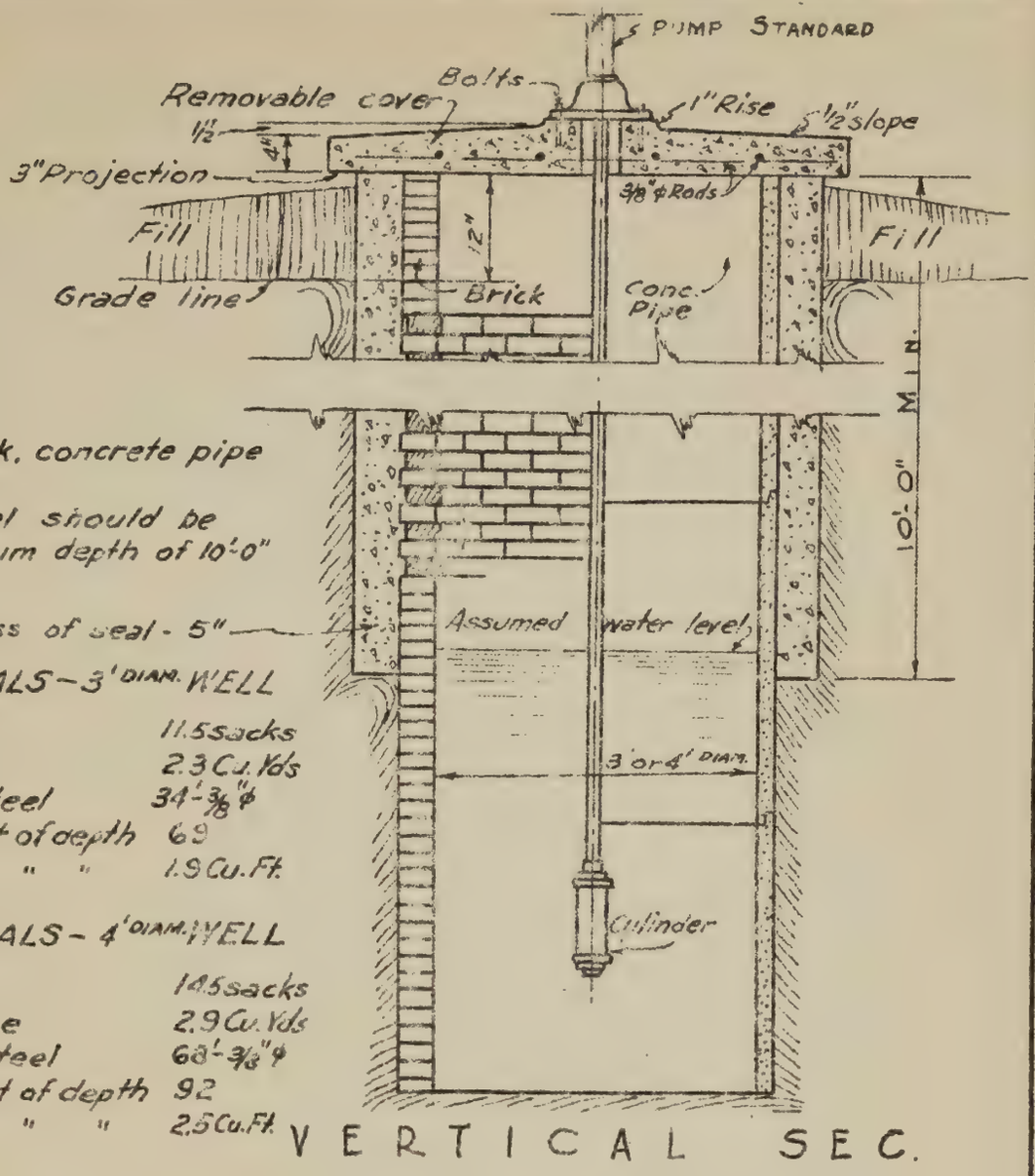
PUMP STANDARDS

Pump standards may be used on shallow wells in conjunction with small cylinders where the riser tubing is not over 2 inches. See Figure 2. The use of this pump standard will permit the installation of a pump jack and engine as auxiliary equipment.

Pump standards may be of either the combination windmill and hand operated force type for use with windmill installation, or the plain hand operated type only for use on underground rainwater cisterns.

The recommended requirements for pump standards are that the piston should operate through a stuffing box and that the base be solid. Open top and split base pump standards permit infiltration of rainwater which may carry contamination into the well or cistern. The following types meet with the above recommended requirements:

Dempster - Figure 23F
Dempster - Figure 226F, and 210F with Fig. 36 Compression Spout
Deming - Figure 329 and 2329
Deming - Figure 444 and 140-A with compression spout
Goulds - Figure 853 and 883
Goulds - Figure 1654
Myers - Figure 2247
Myers - Figure 2244



VERTICAL SEC.

NOTE:
Curbing to be brick, concrete pipe or clay tile.
The concrete seal should be added to a minimum depth of 10'-0"

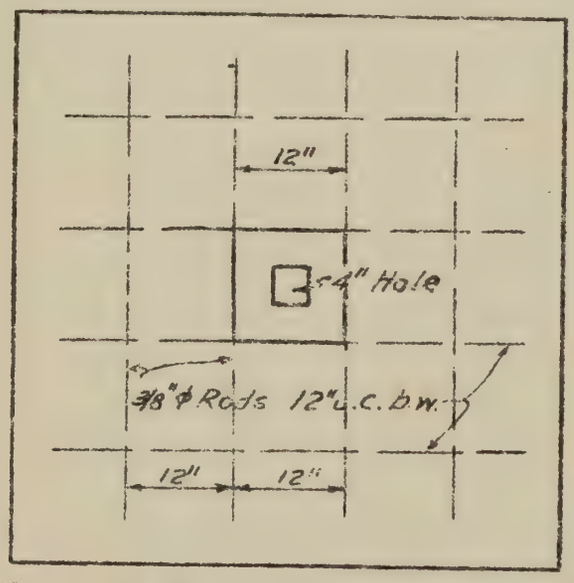
Minimum thickness of seal - 5"

BILL OF MATERIALS - 3' DIAM. WELL

Cement	11.5 sacks
Sand & Stone	2.3 Cu. Yds
Reinforcing steel	34'-3/8" ϕ
Brick per foot of depth	69
Mortar " " " "	1.9 Cu. Ft.

BILL OF MATERIALS - 4' DIAM. WELL

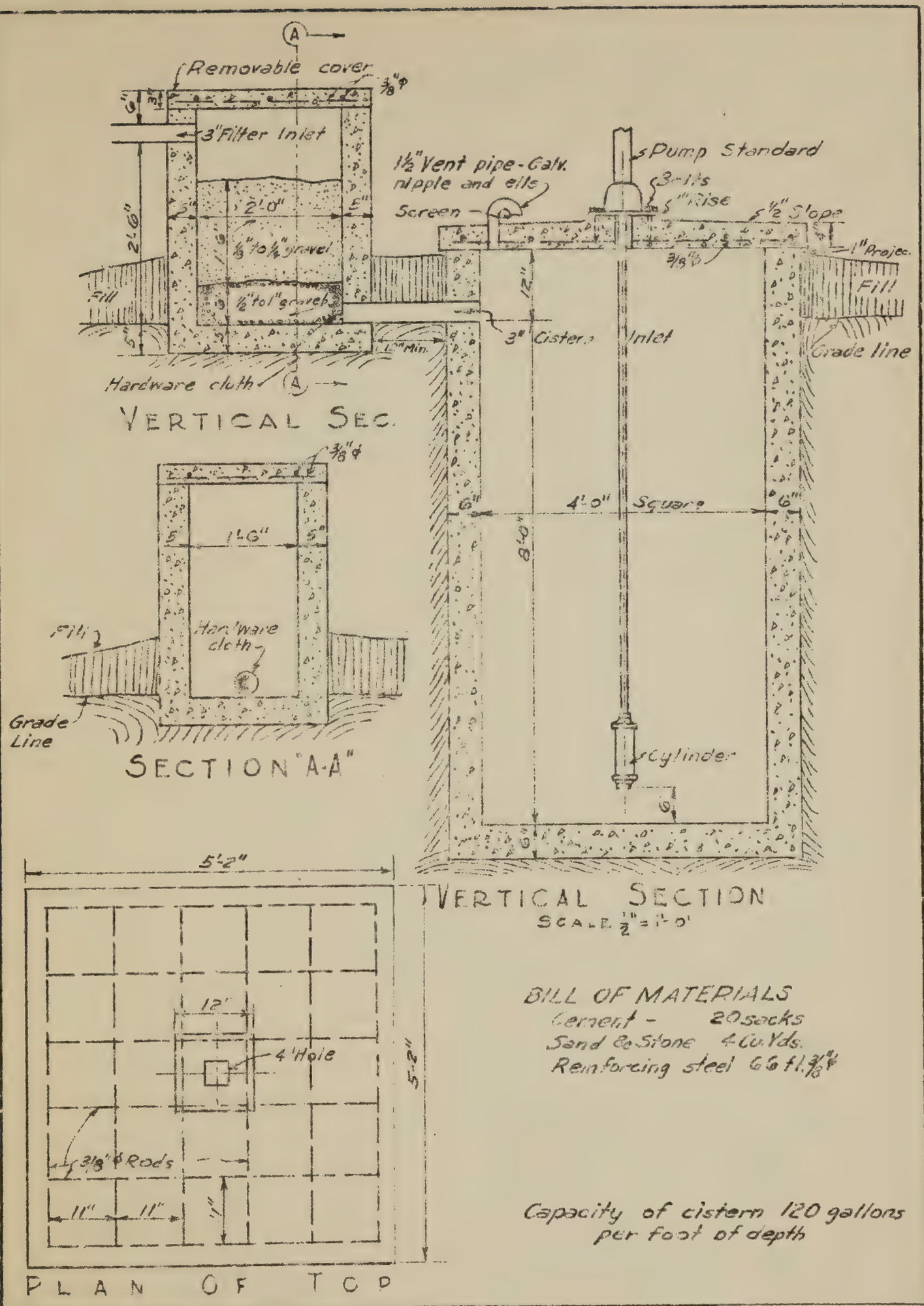
Cement	14.5 sacks
Sand & Stone	2.9 Cu. Yds
Reinforcing steel	68'-3/8" ϕ
Brick per foot of depth	92
Mortar " " " "	2.5 Cu. Ft.



PLAN OF TOP
SCALE: ½" = 1'-0"

F. S. A. DALLAS, TEXAS	DUG WELL	OFFICE OF DISTRICT ENGINEER DISTRICT Nº5 AUG. 1942

FIG. 12



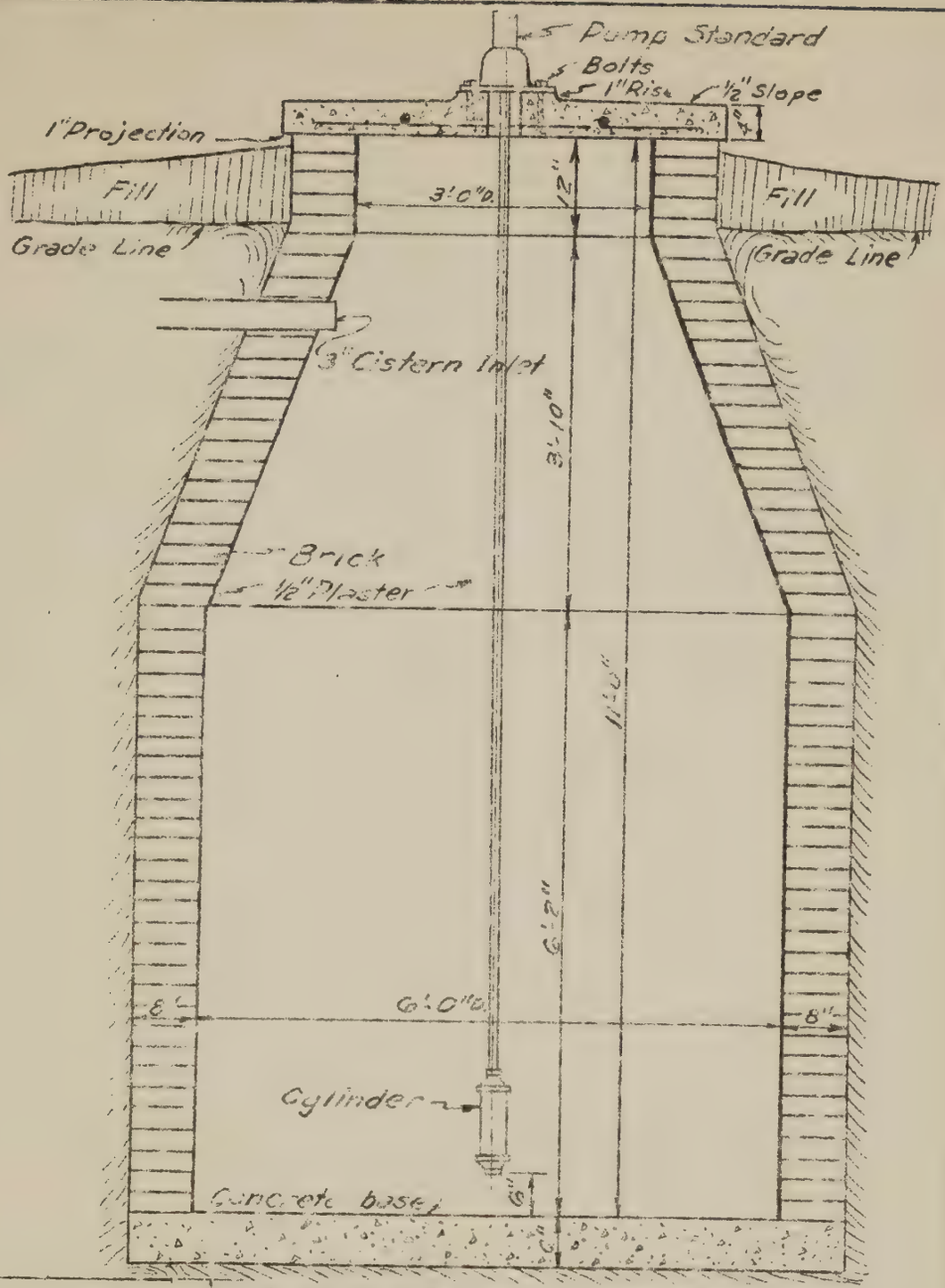
BILL OF MATERIALS

Cement - 20 sacks
Sand & Stone 4 Cu. Yds.
Reinforcing steel 66 ft. 3/8"ϕ

Capacity of cistern 120 gallons per foot of depth

F. S. A. DALLAS, TEXAS	FILTER AND CISTERN	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 AUG. 1942

FIG. 13



VERTICAL SEC.

SCALE: ½"=1'0"

PLAN OF TOP

BILL OF MATERIALS

Cement	5.5 sacks
Sand & Stone	1.1 cu. yds.
Reinforcing steel	17 ft ⅜" ϕ rods
Brick	2810
Mortar	2.8 cu. yds.

Capacity of cistern 1685 gallons

F. S. A. DALLAS, TEXAS	BRICK CISTERN	OFFICE OF DISTRICT ENGINEER DISTRICT No 5 AUG. 1942

FIG. 14

DUG WELLS

In some areas ground water conditions may be encountered which render impracticable the installation of drilled wells. In such areas the construction of dug wells may be given consideration.

Due to their susceptibility to contamination, particular care should be taken in the construction of dug wells in order to provide proper sanitary protection.

All dug wells should be a minimum of 3 feet inside diameter to permit entrance for cleaning purposes. The hole should be dug straight, and for the upper 10 feet should be 10 inches larger in diameter than the remainder of the hole to allow for a concrete sanitary seal. The depth of the well will depend upon the location. Average depth of well for any locality can be estimated by talking to local drillers or inquiring as to depth of wells on adjoining farms.

The well casing or curbing may be formed of common brick laid flat or concrete pipe, and should extend through the water bearing formation and rest on the underlying rock or clay.

If common brick is used, all brick work through the water bearing stratum should be laid without mortar; all brick work above the water bearing stratum should be laid in cement mortar.

If concrete pipe is used, the bottom joint should be perforated through the water bearing stratum.

The well curbing should be brought up to at least one foot above the ground level, and the concrete seal should then be poured around the curbing and brought level with the top of the curbing.

The concrete cover may be pre-cast and then placed over the well. In casting the cover, care should be taken to see that anchor bolts for the pump standard are properly placed and that the necessary slope is given to the top to drain off rainwater.

Figure 12 shows the general type of construction of brick and concrete pipe curbing for dug wells.

CISTERNS

The general use of cisterns for the collection of rainwater to serve as the total water supply for a farm is not recommended; however it is recognized that acceptable or potable ground water supplies are unobtainable in some areas, which naturally forces the farmer to rely upon runoff to creeks, ponds, etc., for stock water, and upon cisterns for strictly domestic supply.

The consumption of water for domestic use under the above conditions should, therefore, be restricted to actual minimum requirements.

The actual anticipated minimum requirement should be determined by the farmer and the cistern designed accordingly, taking into consideration annual and periodic rainfall and anticipated droughtperiods.

Cisterns may be constructed of concrete or new common brick. Concrete cisterns should be square in order to simplify form work; brick cisterns should be circular.

The concrete cistern shown as Figure 13 has a capacity of 960 gallons, which would furnish a supply of 50 gallons per day for 18 days without replenishment, allowing for a cylinder setting of 6 inches from the bottom.

The cistern shown as Figure 14 has a capacity of 1685 gallons, and is of brick construction, with the exception of the bottom and top which must be of concrete. All brick work should be laid up in cement mortar with all vertical joints slushed full and shoved tight.

The filter shown on Figure 13 should be of concrete construction, and should be used with either the concrete or brick cistern. The gravel used must be washed clean before being placed in the filter.

It is not intended that all cistern installations should be restricted to the capacities or types shown on Figures 13 and 14.

Other types which have proven satisfactory under certain ground conditions may be constructed, and cisterns of larger storage capacity of the types shown may also be constructed, provided, that a sketch showing all dimensions, materials and cost estimate be submitted to the Office of the District Engineer for approval, and such approval be received before commencing construction.

It is recommended that the house be provided with eave troughs or gutters with the necessary down spout pipe to serve the entire roof area. Estimates for gutters and downspouts may be obtained from local hardware dealers or sheet metal shops, and since the proper installation of these items requires special tools and equipment, it is recommended that estimates include both the materials and installation.

DISINFECTION OF NEW EQUIPMENT

(Taken from Engineering Handbook, Sanitary Standards for Rural Water Supplies and Systems, April, 1940.)

Whenever a new source of drinking water is developed, whether it be a spring, well, cistern, or storage tank, it must be thoroughly disinfected before being put into use. This disinfection must not be confused with the sterilization of water in connection with treatment. It is done to assure the cleansing of all new equipment and construction.

Disinfection can be done with calcium hypochlorite, better known as chlorinated lime or bleaching powder, containing 30 per cent available chlorine, or high test hypochlorite, commonly called "H.T.H.", or Perchloren, containing approximately 65 per cent available chlorine. A solution of approximately 50 p.p.m. (parts per million) available chlorine should be used to effect complete and proper disinfection of all interior walls of springs and wells. The interior of new cisterns and storage tanks should also be scrubbed down with a smiliar solution. In the case of wells, in order to have the side walls thoroughly washed down it is advisable to pump the solution back into the well.

Table 3 is given to assist in obtaining proper mixtures for disinfecting wells or other sources of supply. The solution may be mixed in a clean container of 30 to 50-gallon capacity and then siphoned or poured into the well or encasement.

TABLE 3. Chart for dosages of 50 parts per million

Capacity of well in gallons	50	100	200	300	400	500	1000
Ounces of chlorinated lime	1.3	2.6	5.2	7.8	10.4	13.0	26.0
Ounces of H.T.H. or Perchloron	0.5	1.0	2.0	3.0	4.0	5.0	10.0

One ounce = 2 level tablespoonfuls: 3 teaspoonfuls = 1 tbsp.

In some instances, it may be possible to effect a more complete dis-

infection of a drilled well by using a perforated can on a rope. The chlorinating powder can be placed in the can and the can weighted so as to reach the bottom of the well. By pulling the can back and forth through the water in the well all the powder will be finally dissolved and the water thoroughly sterilized. In every instance a slight taste and odor of chlorine should be noticable in the water immediately after disinfection.

Table 4 gives the various well and storage tank sizes to assist in computing the quantity of water to be treated under various conditions.

TABLE 4. Well and storage tank capacities in gallons.

Diameter of well	2"	4"	6"	8"	10"	12"			
Gallons of water per vertical foot	.16	.6	1.5	2.6	4.1	6.0			
Diameter of storage tank	2'	3'	4'	5'	6'	7'	8'	9'	10'
Gallons of water per vertical foot	24	53	94	147	212	288	376	477	590

In order to get the total number of gallons of water in any circular well, cistern, or storage tank, take the quantity given in gallons in Table 4 for one vertical foot of the container and multiply by the total vertical feet of water.